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RESPIRATORY EXCHANGE, WITH A DESCRIPTION OF A RESPIRATION APPARATUS FOR CLINICAL USE.*

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AND

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PART I.

RESPIRATORY EXCHANGE, WITH SPECIAL REFERENCE TO ITS SIGNIFICANCE AND PATHOLOGY.

COMPARATIVELY little attention has been given by American clinicians to the significance of the respiratory exchange in pathological cases, but a study of this factor may show results of considerable value in the treatment of disease. For example, the respiratory exchange may be used to interpret a gain or loss in body-weight. While a change in body-weight is one of the most commonly used indices, the idea that the material gained or lost varies in character is relatively new. In fact, many clinicians are perhaps not aware that a loss in weight (especially an initial loss in weight) may be largely due to a loss of water from the body, even with patients not oedematous. Furthermore, they may have no knowledge as to whether the loss consists of fat, muscle, or carbohydrate. A total loss in weight may be an indication of a wasting disease or, as in the case of obesity, an actual advantage. A loss in weight due to the loss of a specific material, may, however, vary in its interpretation according to the character of the material; thus, a loss of muscle and particularly a loss of carbohydrate would have a far greater significance than a loss of fat. A definite knowledge of the character of the loss in weight may be obtained by a study of the respiratory exchange.

In pathological cases it is distinctly of importance to know whether or not the demand for nutriment, as indicated by the total amounts of material consumed in the body, is met by the supply. If the loss or gain in body-weight is the only index depended upon by the clinician, a deficiency or excess of nutriment is shown only after an observation of several days or even weeks and valuable time is thus lost; furthermore, it is quite possible that losses or gains of organized body tissue, such as fat or muscle, may be completely masked by a change in the very large amount of water in the body. On the other hand, observations of the respiratory exchange will show very quickly the demand for energy under the conditions of observation, enabling the clinician to adjust without delay the supply to the demand.

Practically the only work that has been published from American clinics upon the respiratory exchange in pathological cases has been carried out in three laboratories, that of the Russell Sage Institute of Pathology in New York, that recently published by Means from the Massachusetts General Hospital, and that which was begun in 1909 and is being continued at the present time by the Nutrition Laboratory

* From the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Mass.

of the Carnegie Institution of Washington in Boston. It was soon recognized in the observations carried on by the Nutrition Laboratory that the majority of the earlier methods of studying the respiratory exchange were, for one reason or another, precluded from general acceptance in clinics and an attempt was made to broaden the field of study and increase the potentialities by devising, constructing, and testing a relatively simple apparatus called the "universal respiration apparatus." With this apparatus it is possible to measure the carbon-dioxide output and the oxygen intake with almost as high a degree of accuracy as with the costly calorimetric respiration chambers. While the apparatus has been used in a considerable number of studies with pathological cases, it was soon found that the method of connection with the subject by means of nosepieces or a mouthpiece was objectionable to many patients and we now have reason to believe that it often interfered with normal respiration. The construction of an apparatus which should be specially adapted for clinical use was, therefore, made a subject of further study. Before giving the results of this study, however, it seems desirable to define exactly what is meant by the terms "respiratory exchange" and "respiratory quotient," to consider their relation to the heat production and to outline the fundamental principles underlying a study of the respiratory exchange and the essentials for an apparatus designed for such use in pathological cases.

RESPIRATORY EXCHANGE.

The elementary physiological fact that considerable carbon dioxide is produced in the body is easily demonstrated by the familiar experiment of breathing into a test tube filled with lime water. That oxygen is being continually utilized by the body is less easily demonstrated and we must rely upon the extensive findings of chemical and physiological laboratories for the conclusive evidence that in all living processes not only is carbon dioxide produced, but oxygen is consumed. A quantitative knowledge of the amounts of carbon dioxide excreted and oxygen consumed by human subjects has important theoretical as well as practical uses; this may best be shown by a consideration of the fundamental processes of metabolism.

From the chemical composition of the various important nutrients, such as sugars and fats, a computation may be made of the amount of oxygen required to oxidize completely one gram of the substance as well as of the amount of carbon dioxide produced in such oxidation. These calculations may be verified by burning a known weight of a pure nutrient, such as milk sugar or pure fat, in a calorimetric bomb containing oxygen under high pressure to assure complete combustion. Simultaneously the heat liberated in such combustion may be directly measured. As a result of a series of such calculations and actual combustions, definite data regarding the production of carbon dioxide, the oxygen required for complete combustion, and the amount of heat liberated for several of the three most important classes of nutrients have been collected in Table 1. As will be shown later, the ratios between the volumes of carbon dioxide produced and the oxygen consumed, and the heat production per gram or per liter of carbon dioxide produced or oxygen consumed are of special significance.

In the calorimetric bomb the end-products of combustion of sugar and fats are carbon dioxide and water. Precisely the same process takes place when the sugars and fats are burned in the animal body for, under ordinary conditions, they are converted to the same end-products, *i.e.*, carbon dioxide and water. The carbon dioxide is excreted from the body in gaseous form. The water produced by the oxidation of organic material may be excreted through the kidneys, may pass through the lungs and skin, or be added to the residual water always present in the body. All of the carbon burned in the body is, therefore, converted to carbon dioxide, but all of the oxygen absorbed is not converted into carbon dioxide but may be in part converted into water.

TABLE I.—RESPIRATORY QUOTIENTS FOR PROTEIN, FATS, AND CARBOHYDRATES.

Materials.	Oxygen Required to Oxidize 1 Gram.		Produced in the Oxidation of 1 Gram.			Respiratory Quotient. $\frac{CO_2 \text{ c.c.}}{O_2 \text{ c.c.}}$	Heat.			
	Weight.	Volume.	Carbon Dioxide. Weight.	Carbon Dioxide. Volume.	Heat.		Per Gram of Oxygen.	Per Liter of Oxygen.	Per Gram of Carbon Dioxide.	Per Liter of Carbon Dioxide.
	Grams.	C.c.	Grams.	C.c.	Cal.		Cal.	Cal.	Cal.	Cal.
Starch	1.185	829.3	1.629	829.3	4.20	1.000	3.54	5.06	2.58	5.06
Cane sugar....	1.122	785.5	1.543	785.5	3.96	1.000	3.53	5.04	2.57	5.04
Milk sugar[1]....	1.066	746.2	1.466	746.2	3.75	1.000	3.52	5.03	2.56	5.03
Animal fat.....	2.876	2013.2	2.811	1431.1	9.50	0.711	3.30	4.72	3.38	6.64
Human fat.....	2.844	1990.8	2.790	1420.4	9.54	0.713	3.35	4.79	3.42	6.72
Protein[2]	1.367	956.9	1.520	773.8	4.40[3]	0.809	3.22	4.60	2.89	5.69

[1] These values apply likewise to dextrose and levulose.

[2] While this computation is based upon meat protein, the values will be essentially the same for all proteins. These values represent quantities found when burning protein not in a calorimetric bomb, but in the animal body.

[3] The heat of combustion of protein averages 5.65 calories per gram; deducting the unoxidized material in the urine, the heat per gram would be 4.40 calories. For discussion of this point, see Atwater and Bryant, Storrs' (Connecticut) Agr. Expt. Sta. Rept., 1899, p. 73. Since this value has to deal with protein actually burned, it is not to be confused with the value 4.1, commonly used to calculate the calories from ingested protein of which a portion is assumed to be excreted undigested in the feces.

The relationship between the oxygen consumed and the carbon dioxide produced has been designated as the *respiratory quotient*. This relationship has a great physiological value and plays an important rôle in indicating the character of the material burned in the body. The theoretical respiratory quotient for the combustion of pure substances of definite chemical composition may be easily computed. Thus the simplest carbohydrate, glucose or dextrose, with a chemical formula of $C_6H_{12}O_6$, contains in its molecule sufficient hydrogen and oxygen to form water, and theoretically, at least, only enough oxygen is required from the air in the respiratory tract to burn the carbon in the substance. The simplest chemical reaction is therefore:

$$C_6H_{12}O_6 + 6\,O_2 = 6\,CO_2 + 6\,H_2O$$

which shows that for every 6 molecules of oxygen absorbed, there are produced 6 molecules of carbon dioxide. Inasmuch as equal volumes of all gases contain the same number of molecules, when a pure carbohydrate such as glucose is burned, 1 liter of carbon dioxide is produced for every liter of oxygen consumed, and the volume ratio, *i.e.* $\frac{\text{Volume } CO_2}{\text{Volume } O_2}$ equals 1.00. The volume ratio or *respiratory quotient* not only of glucose, but of all other carbohydrates, including starch, cane and milk sugar, levulose and dextrose, is likewise 1.00. This is true, regardless of whether the combustion is carried on in the calorimetric bomb, or in the animal body. Therefore, if a measurement is made of the total oxygen consumption and the total carbon-dioxide production of a living animal, and the volumes of the carbon dioxide produced and the oxygen consumed are found to be equal, we say that the respiratory quotient of the animal at that time is 1.00.

A similar computation may be made for fat. Using the chemical composition of pure fat, we find that 1 gram of human fat requires 2.844 grams of oxygen (1,990.8 c.c.) for its combustion, and that as a result of the combustion 2.790 grams or 1,420.4 c.c. of carbon dioxide are produced. Under these conditions the respiratory quotient would be:

$$\frac{\text{Volume } CO_2}{\text{Volume } O_2} = \frac{1420.4}{1990.8} = 0.713$$

The calculation of the theoretical respiratory quotient of protein is less simple, owing to the fact that protein is only incompletely oxidized, a portion of the protein molecule being excreted unburned in the form of uric acid, urea, and other allied compounds in the urine. By the majority of writers the respiratory quotient of protein is considered as equal to 0.81.

A reference to Table 1 will show that carbohydrates have a respiratory quotient of 1.00, fat of approximately 0.71, and protein of 0.81. From these factors, therefore, it can be seen that the respiratory quotient of a living animal may show wide variations, which will depend upon the class of nutrients burned in the body; it is accordingly easy to determine the character of the catabolism from the value of the respiratory quotient. Thus, if the metabolism is determined during complete starvation, *i.e.* when the subject is subsisting upon body fat and protein and the tissue burned is chiefly fat, the respiratory quotient would tend to fall, gradually approaching 0.71, the characteristic quotient for the combustion of fat. On the other hand, if a diet consisting largely of carbohydrates is taken, the respiratory quotient would tend to approach 1.00, the quotient characteristic of carbohydrate combustion.

As has been said, the calculation of the respiratory quotient for protein is theoretically very complex, but fortunately the rôle played by protein metabolism in the total metabolism is relatively small and remarkably constant, Magnus-Levy computing that the disintegration of protein is not far from 15% of the total catabolism. He further calculates that if the remaining 85% of the total metabolism is of carbohydrate alone, then the respiratory quotient, as a result of the existing combination of combustible materials, would be 0.971 instead of that of pure carbohydrate (1.00). On the other hand, if the remaining 85% of the catabolism is solely of fat, the respiratory quotient would be 0.722, instead of that of pure fat (0.71). If, therefore, the respiratory quotient lies between 0.71 and 1.00, and the nitrogenous excretion of the urine is known, an estimation can be made of the part played by protein, carbohydrate, and fat in the catabolism in the body.

Under ordinary conditions the respiratory quotient would lie between these two points. Values above or below them might reasonably be considered as due to faulty technic, or to a distinctly abnormal catabolism. If above 1.00, they might also be due to the formation of fat from carbohydrate, in which process carbon dioxide would be split off unaccompanied by the absorption of oxygen, and if below 0.71, to the possible formation of carbohydrate from fat, with a consequent absorption of oxygen unaccompanied by the production of carbon dioxide. It is thus clear that when the respiratory quotient is carefully determined considerable light may be thrown upon the character of the material burned in the body.

RESPIRATORY EXCHANGE AND HEAT PRODUCTION.

When sugar or fat is burned in the calorimetric bomb, the consumption of oxygen and the formation of carbon dioxide are accompanied by the liberation of a definite amount of heat. The heat liberated per gram by the principal classes of nutrients is included in Table 1, together with the heat production per gram and per liter of oxygen consumed and of carbon dioxide produced. The ratios between the heat production and the oxygen consumption or the

carbon-dioxide production are termed the *calorific equivalents* of oxygen and carbon dioxide respectively. These ratios are of equal, if not indeed greater, importance than the respiratory quotients for, by determining carefully the oxygen consumption and the carbon-dioxide production of a living organism, the energy production may also be computed with reasonable accuracy by means of the calorific equivalents of oxygen and carbon dioxide. It will be seen, therefore, that a study of the respiratory exchange gives us information not only regarding the character of the material burned, but definite information as to the total energy exchange of the living organism.

With the calorific equivalents as with the volume ratios between the oxygen consumption and the carbon-dioxide production, we find that considerable differences exist according to whether fat or carbohydrate is burned. Thus for each gram of carbon dioxide formed in the combustion of carbohydrate, 2.57 calories are liberated, and for every liter of carbon dioxide produced 5.04 calories. When fats are burned, the amount of heat per gram of carbon dioxide increases on an average to 3:40 calories and per liter to 6.68 calories. To apply intelligently a factor representing the heat production per gram of carbon dioxide, therefore, it is essential to know whether the energy is derived from the combustion of carbohydrate or of fat or, if from both, in what proportion. This fact may explain the difficulties incidental to the estimation of the total metabolism in the earlier development of respiration apparatus.

The measurement of the carbon dioxide produced by a living organism presents relatively few technical difficulties, and was early accomplished by Pettenkofer and Voit in their classical research. At that time the results obtained from the measurement of the carbon dioxide alone were considered of sufficient value from which to formulate broad physiological laws and, by using the average value for the calorific equivalent of carbon dioxide, experimenters computed the total energy transformations with a reasonable degree of accuracy. While with normal individuals it might be assumed without too great a violation of facts that there would be equal quantities of carbohydrate and fat involved in the metabolism and an average calorific value for carbon dioxide produced, this could not be assumed in pathological cases.

On the other hand, an examination of the calorific equivalents of oxygen shows that these values are much more nearly uniform, and that the amount of heat produced per gram of oxygen absorbed is much the same, irrespective of the material burned. Thus each liter of oxygen involved in the oxidation of carbohydrate corresponds to the liberation of 5.04 calories, while if pure fat alone is oxidized, each liter of oxygen is accompanied by the liberation of 4.75 calories. Inasmuch as the calorific equivalent of carbon dioxide varies approximately 25%, according to whether carbohydrate or fat is burned in the body, while that of oxygen when fat is burned is but 6% lower than when carbohydrate is burned, it will be seen that the direct determination of the oxygen consumption gives the better measurement of the energy output of the body. Accordingly, the values for the oxygen consumption alone supply an index of heat production which is very nearly that which would be obtained by an actual measurement of the heat given off by a patient.

A complete study of the respiratory exchange would, therefore, consist of an accurate measurement of the carbon dioxide produced and the oxygen consumed. From these data we may compute: (1) the respiratory quotient and the character of the material burned in the body, and (2) the total heat production of the body and the fuel needs of the body, or, in the absence of food, the drafts upon the body substance.

RESPIRATORY EXCHANGE IN PATHOLOGICAL CASES.

In pathological cases not only is a knowledge of the total metabolism of great importance, but from the respiratory quotient and its interpretation much important information is derived regarding the character of the catabolism which may prove of even greater value than the data regarding the total metabolism. Thus far in perhaps no disease in which the respiratory exchange has been studied has the significance of the respiratory quotient played the rôle that it does in diabetes, in which the amount of carbohydrate burned is a very important factor. It will be remembered that it has already been shown that the combustion of carbohydrate tends to increase the respiratory quotient towards 1.00. With diabetics the combustion of carbohydrates is admittedly at a low point; hence respiratory quotients approximating 0.71 (or 0.72, that of a protein-fat diet) are commonly to be expected. At the present day our knowledge with regard to the amount of carbohydrate burned in diabetes is almost exclusively confined to the crude balance which can be struck between the carbohydrate ingested and the sugar excreted in the urine, the assumption being made that the difference between the two represented the amount of carbohydrate burned, since the evidence thus far accumulated indicates that relatively little, if any, carbohydrate is excreted in the feces. We may, however, by determining the respiratory quotient of a patient and noting the relation it bears to the theoretical respiratory quotient of fat on the one hand (0.71) and of carbohydrate on the other (1.00) obtain important information regarding the amount of carbohydrate burned. An accurate knowledge of the respiratory quotient in pathological cases may, therefore, be of fundamental importance, inasmuch as it pro-

vides an admirable index as to the character of the catabolism.

Furthermore, it is known that in the severe acidosis stage of diabetes there is a very marked increase in the total metabolism. This is readily shown in a study of the gaseous exchange. Under the conditions existing in this stage of diabetes, the problem is greatly simplified, for here one may assume with a high degree of probability that the carbon dioxide production results almost exclusively from the combustion of fat. Hence the determination of the carbon dioxide production alone may be used for calculating the total amount of the metabolism. Accordingly, if the total carbon-dioxide excretion of a patient with severe diabetes* is known, the total metabolism is readily computed by using as a factor the calorific equivalent of carbon dioxide corresponding to the combustion of fat, namely, 3.40 calories per gram of carbon dioxide, or 6.68 calories per liter.

FUNDAMENTAL PRINCIPLES UNDERLYING EXISTING METHODS OF STUDYING THE RESPIRATORY EXCHANGE.

A study of the respiratory exchange represents a stage in experimentation on metabolism that is entirely outside the experience of the ordinary clinician. The so-called metabolism experiments, which involve the measurement of the food intake and perhaps an analysis, in part, more or less complicated, of the urine and the feces, rest upon technic long established and relatively simple in carrying out. The technic required for a study of the gaseous metabolism is, on the other hand, very much more complicated, involving gas analyses, for the air in passing through the lungs gives up its oxygen to the blood and receives the carbon dioxide produced, thus resulting in a deficit in oxygen and a considerable increment in carbon dioxide. In entering upon such a study, one finds immediately that it is not a simple problem to separate and collect the inspired and expired air. Subsequent to this collection is the measurement of the volume of air expired or inspired, and finally the sampling and analysis of the gaseous mixtures. All of these processes present difficulties which are not directly comparable to the relatively simple collection and measurement of food, feces, and urine.

The respiration apparatus used in a study of the respiratory exchange are of two essentially different types. With one type the subject breathes through a nose-breathing or mouth-breathing appliance, and the inspired air and expired air are separated by valves or the expired air is conducted mechanically, by means of a motor and a ventilating fan, through absorbents which remove the carbon dioxide. In some forms of this type of apparatus the expired air is sampled by a spirometer or a meter and the carbon dioxide increment and oxygen deficit determined by analysis.

The second type of respiration apparatus is the so-called chamber method, in which the subject lies inside of a respiration chamber of suitable size, and accordingly his respiration is perfectly free and normal. The chamber may be entirely closed, and the carbon dioxide allowed to accumulate, the changes in composition of the air being determined by analysis from time to time or, as is almost invariably the case, it may be well ventilated, as was the chamber of Pettenkofer, and later that of Jaquet. Finally, the chamber may be so arranged that it forms a part of a closed circuit apparatus, with a ventilating air-current, the carbon dioxide given off by the subject being removed from the air by absorption with soda lime and the oxygen consumed being replaced by the admission of fresh oxygen, so that the ventilating current of air returns to the chamber with essentially the same composition as normal air.

Of the mouth-breathing type of apparatus, none is better known than that of Zuntz, or has rendered a greater service to physiology and pathology. The Zuntz apparatus has been subjected to a most critical examination and comparison with other respiration apparatus by Dr. T. M. Carpenter of this laboratory. The results have recently been reported by Dr. Carpenter in a monograph devoted to a comparison of the existing methods for studying the respiratory exchange.[1]

Of the types of respiration chamber in common use, that of Pettenkofer and Voit involves only the determination of the carbon dioxide, but, as has already been stated, the direct determination of the oxygen consumption is absolutely essential. A chamber apparatus by means of which both the carbon dioxide production and the oxygen absorption can be determined has been successfully developed by Jaquet and simultaneously on the same principle by Hasselbalch, the latter using it for researches with infants. With this apparatus both the incoming and outgoing air is analyzed and the carbon dioxide content and oxygen deficit determined, the carbon dioxide production and oxygen consumption being computed from the results. The Jaquet method has been most successfully used and a number of experiments reported by Grafe in Heidelberg.

The determination of the carbon dioxide in both the ingoing and outgoing air of the respiration chamber is a relatively simple matter. The determination of the oxygen deficit, on the other hand, is a very complicated one. Practically the only gas analysis apparatus which measures exactly the oxygen deficit in the chamber method is that devised by Pettersson and recommended by Jaquet and by Grafe. The modified form of Sondén is even more exact. Extensive experience in this laboratory has shown, however, that

* The astonishing change in the respiratory exchange following the Allen fasting treatment is discussed later.

while the principle of determining the oxygen deficit in the outcoming current of air by means of the Sondén-Pettersson gas analysis apparatus is theoretically sound, and in the hands of a skilled analyst can actually be accomplished, it is extraordinarily difficult as well as time-consuming and tedious.

The type of respiration chamber in which there is no ventilation and the carbon dioxide is allowed to accumulate, is rarely used for human subjects, although occasionally used for animals. The respiration chamber with a ventilating current of air which passes through absorbents to remove the carbon dioxide, and to which oxygen is added to bring it to an approximately normal composition, was first used by Regnault and Reiset for small animals and later by Hoppe-Seyler for men. It has received its most extensive use for men in the laboratory of Wesleyan University, Middletown, Conn., and later in the Nutrition Laboratory. Recently admirable models of this type have been constructed by the United States Department of Agriculture in Washington, D. C., and by the Russell Sage Institute of Pathology in New York. With many of these apparatus the heat given off by the subject may also be measured directly.

The importance of determining the total metabolism under varying conditions of health, disease, muscular work, climate, temperature environment, etc., has resulted in an extensive amount of scientific research. It is probably safe to say that the determination of the total metabolism has been the basis of the development of practically all present-day forms of respiration apparatus. Even the respiration calorimeter developed at Wesleyan University, Middletown, Conn., and its successors were constructed primarily to measure directly the heat output from the body, and secondly, to measure the gaseous metabolism, with special reference to the total metabolism. In their construction a sufficiently large space was provided in the chamber to make the subject comfortable, and it was freely admitted that while the determinations of the carbon dioxide production were exact in short periods, the highest degree of accuracy for the measurements of oxygen consumption could be expected only in relatively long periods.

The simple universal respiration apparatus devised in the Nutrition Laboratory was intended to serve as a substitute for these costly respiration calorimeters, and to make more available the clinical use of studies of the respiratory exchange. It was assumed that subjects could breathe normally through nosepieces or a mouthpiece. While especial stress was laid primarily upon measurements of the total metabolism, such respiratory quotients as were found were usually assumed to be correct and probably not vitiated by the method of measurement. Nevertheless, it is of special importance to bear in mind that in the development of practically all forms of apparatus for measuring the respiratory exchange, emphasis was laid primarily upon their capability for measuring the total metabolism and only incidentally on the measurements of the respiratory quotient. Gradually, however, the importance of the respiratory quotient has compelled investigators to seek to develop apparatus which will render this type of study easy, and we may now say that *only that form of apparatus which permits exact determinations of the respiratory quotient as well as of the total metabolism, need be seriously considered for the best clinical work.*

CRITIQUE OF EXISTING APPARATUS FOR THE DETERMINATION OF THE RESPIRATORY QUOTIENT.

The various types of respiration apparatus now in existence have certain technical difficulties which may reasonably be criticized. The determination of the respiratory quotient represents the highest stage of experimental technique, since the value of this factor is affected by errors in the determination of either the carbon dioxide content of the air or the oxygen deficit. We may, therefore, confine our criticism of existing apparatus primarily to the accuracy of the determinations of the respiratory quotient. In studying the respiratory quotient with any type of apparatus, we have two classes of important factors to deal with, first, the physical or technical factors and second, the physiological factors.

TECHNICAL FACTORS.

From an analysis of the fundamental principle underlying the two main methods for determining the respiratory exchange, *i.e.*, the mouth-breathing or nose-breathing appliance method and the chamber method, it is obvious that for the determination of the respiratory quotient, the direct determination of the carbon-dioxide increment in the expired air and the oxygen deficit with the admirable methods of gas analysis now available, is probably the best method from a purely technical standpoint. The methods of Tissot, Speck, and Zuntz belong to this class.

As the air passes through the lungs, oxygen is removed from it and carbon dioxide added. By an exact chemical analysis of the air entering and leaving the lungs, the deficit in oxygen as well as the increment in carbon dioxide may be determined; using these data and making minor assumptions, the respiratory quotient may then be computed. As commonly carried out this fundamental method involves either nose-breathing or mouth-breathing appliances, and yet it should be here pointed out that the chamber method of Jaquet and Hasselbalch does not in reality differ fundamentally from the methods of Tissot, Speck, and Zuntz. Theoretically, these latter methods should be so modified as to include the cutaneous respiration as, indeed, is the case with the Jaquet method, but for the present

we may disregard entirely the question of cutaneous respiration* and maintain that the method is technically perfect.

Those methods involving the determination of carbon dioxide production and oxygen consumption by two independent procedures, each with its possible individual errors, are theoretically inferior. This criticism applies to the respiration calorimeter and to the universal respiration apparatus, but does not apply to the Jaquet-Hasselbalch chamber. Yet the innumerable control tests with burning alcohol and ether have shown that, in actual practice, this criticism is disproved, for results with a very high degree of accuracy are usual in such control tests. As a consequence we may state that both methods have now been brought to technical perfection.

PHYSIOLOGICAL FACTORS.

The physiological factors are less often borne in mind. The essential differences between the two forms of apparatus from the physiological standpoint are, in the first place, that the subject is in one instance breathing with a mouth-breathing or nose-breathing appliance and consequently with the nose or mouth firmly closed, and in the other he is lying in an atmospheric environment not essentially different from that of an ordinary room. Physiologically, it is important to consider whether there are any abnormal features in either of these conditions which could affect, in any way, the determination of the respiratory quotient. To be capable of significant interpretation, the respiratory quotient should deal not with the carbon dioxide *excretion* and oxygen *absorption* during a given time, but with the carbon dioxide *production* and oxygen *consumption*. Between carbon dioxide excretion and carbon dioxide production there may be a very great difference, for there may be a change in the preformed carbon dioxide in the body and thus a false respiratory quotient would be obtained. Likewise there should be no change in the oxygen physically absorbed, *i.e.*, chemically uncombined in the body fluids.

A superficial inspection will show that there is much more liability of difference between the carbon dioxide *excretion* and the carbon dioxide *production*, than there is between oxygen *absorption* and oxygen *consumption*. Of the errors liable to affect the residua of preformed carbon dioxide in the body, we may note first a mechanical alteration in the ventilation, such as excessive ventilation ("Auspumpen") or retarded or decreased ventilation, the first resulting in an excessive excretion of carbon dioxide and the second, in the retention of carbon dioxide or an accumulation of preformed carbon dioxide in the body. In addition to these mechanical alterations in the ventilation, there may be a chemical alteration in the carbon dioxide which may result from a change in the acidity of the blood, thus causing a change in the residua of carbon dioxide, wholly independent of the carbon dioxide production. It is probable, also that sleep may affect the mechanics of ventilation and, possibly, results obtained with subjects who are asleep in one experimental period should not be compared with those obtained in another period while the subjects are awake. This question should be carefully studied. Unfortunately, however, methods of studying the respiratory exchange which involve the use of breathing appliances attached to the face practically preclude such study during deep sleep.*

PRIME REQUISITES FOR A METHOD OF STUDYING THE RESPIRATORY EXCHANGE.

Prior to a description of the development or the construction of a new form of apparatus for the study of the respiratory exchange, it is important to take into consideration the conditions that must be met by such an apparatus, in the light of existing knowledge regarding the respiratory exchange. While it is admitted that most of the apparatus now in use in such studies is technically very satisfactory, especially for the determination of either the oxygen consumption or the carbon dioxide production, the technique for the accurate determination of the respiratory quotient still leaves something to be desired. Of the physiological factors the following should be striven for:

First, the subjects should be in complete muscular repose for some time, usually not less than 30 minutes, prior to the experiment. Since muscular activity is necessarily accompanied by a greater carbon dioxide production and an increase in the ventilation of the lungs, which results in a more or less prolonged disturbance of the respiratory rhythm, this condition of muscular repose is important. Second, there should be free, untrammeled breathing with as little consciousness of the respirations as possible. Third, theoretically at least, the complete gaseous emanations from the body should be measured, *i.e.*, the respiratory exchange should be studied in such a manner as to include the cutaneous respiration. Fourth, there should be a uniform condition of awake or asleep. Since during sleep complete muscular repose is probably more easily secured, sleep is preferable. Fifth, the experimental period should be sufficiently long to equalize any minor, transitory changes in the respiratory type or rhythm. Theoretically the period should be as long as it can be without a change in the body storage, *i.e.* until a change in the quotient is normally to be expected by a depletion in glycogen or sugar storage.

In our plans for the study of clinical cases and, indeed, cases with which there may be at the beginning abnormal respiration, it seemed impossible, owing to the known abnormalities of

* Commonly assumed not to exceed two per cent. of the total gaseous exchange.

* With long-trained subjects, Dr. T. M. Carpenter has recently most successfully accomplished this.

mouth-breathing or nose-breathing appliances, to consider any but the respiration chamber method. While one may say that the placing of a subject in an enclosed chamber for the purpose of studying the respiratory exchange is a distinctly abnormal procedure, repeated experiments with the large calorimeters have shown that, except in very rare cases, the subject immediately adjusts himself to the conditions and frequently sleeps through the entire experimental period. On the other hand, the insertion of the nosepieces or the mouthpiece is almost invariably followed by a distinct alteration in the type of respiration, even though often there are no external evidences of discomfort. This is no more sharply shown than when pneumograph records are secured of the respiration with the subject breathing normally and comparisons made with records obtained with the subject breathing through a mouthpiece or nosepieces. Very noticeable alterations of the respiratory type are almost invariably found, especially with untrained subjects. Furthermore, personal conversation with many physiologists, both in America and in Europe, has led us to believe that it is the almost universal opinion that breathing through nose or mouth appliances, save in the case of exceptionally well-trained subjects, produces an abnormal type of respiration.

Consequently, in deciding upon a method for studying the respiratory quotient to be developed in the Nutrition Laboratory, the original plan was to construct a chamber which would meet all of the conditions requisite for successful experimentation and use it attached to the universal respiration apparatus. This method seemed especially feasible, as smaller chambers had been successfully used with this apparatus in studies with dogs and infants. In devising this respiration chamber we profited by the previous experiences of the Laboratory with the large chambers used in the respiration calorimeters and attempted in so far as possible to eliminate all particularly troublesome factors.

Recognizing, also, that any form of apparatus so complicated and costly as the respiration calorimeters in the Nutrition Laboratory and the Russell Sage Institute of Pathology was practicable for only a very few hospitals, the attempt was made to develop a respiration chamber for use with the universal respiration apparatus which would provide for the measurement of the carbon dioxide production and the oxygen consumption of patients in relatively short periods and still not be prohibitive in cost. It was not possible in such an apparatus, therefore, to introduce costly appliances for the direct measurement of the heat output. Fortunately, however, almost all of the evidence that has accumulated at the present time points to the fact that the larger proportion of experiments may well be made by determining the heat production indirectly from the measurements of the carbon dioxide production and the oxygen consumption, provided that these are accurate.

A detailed description of the apparatus as finally developed and a number of results obtained with it on pathological subjects are given in Part II of this paper.

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(To be continued.)

STUDIES OF THE BASAL METABOLISM IN DISEASE AND THEIR IMPORTANCE IN CLINICAL MEDICINE.

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IN a recent paper, Professor Lusk has referred to the calorimeter as the interpreter of life processes.[1] This might be broadened to calorimetry, and calorimetry, as I shall presently explain, can be carried out without a calorimeter.

What is calorimetry?

As generally used at present, the term includes (*a*) the determination of the heat given off by an organism, by actual measurement; that is, the heat elimination; and (*b*) the calculation of the heat production from the gas exchange. The former is called direct, the latter indirect calorimetry. Direct calorimetry can be done only by means of the calorimeter, an instrument costing several thousand dollars; indirect calorimetry, on the other hand, can be carried out with any of a number of different types of respiration apparatus, the cheapest of which need not cost over $75.*

Studies of the gas exchange in man and animals have been made by scientists since the days of Lavoisier, but it is only comparatively recently that Magnus-Levy,[2] and more particularly the workers at the Russell Sage Institute at Bellevue Hospital, New York,[3] have shown the importance of calorimetry in internal medicine.

The elimination of heat and the production of heat, as determined by direct and indirect calorimetry, respectively, usually agree within a few per cent. so that studies by the latter method alone will serve most purposes. When one obtains the elimination of heat by direct calorimetry he expresses the result in heat units —calories. If, now, we wish to calculate the heat production in calories, we may do so by determining the oxygen absorption and the respiratory quotient. The latter is the volume of carbon dioxide eliminated divided by that of the oxygen absorbed in any given time unit.

* I refer to the Douglas respiration apparatus, which may be had from Siebe, Gorman & Co., London.

The respiratory quotient is of importance because it is an index of the kind of material being burned in the body. In the case of any given food substance, whether burned in the body or in a retort, the consumption of a definite amount of oxygen will result in the evolution of a definite amount of carbon dioxide. In other words, the ratio $\frac{CO_2}{O_2}$ will be a constant, for any given substance, but will vary with different substances according to the structure of their molecules. The more highly oxidized a substance is at the start, the smaller the amount of oxygen that will be required to complete the oxidation, hence the higher will be the ratio $\frac{CO_2}{O_2}$.

Of the three classes of substances that may be burned in the body, carbohydrates, fats and proteins, we know the respiratory quotients. For example, in the case of grape sugar, which has an empirical formula of $C_6H_{12}O_6$, and which is completely oxidized according to the reaction

$$C_6H_{12}O_6 + 6O_2 = 6CO_2 + 2H_2O,$$

there will be given off the same number of molecules of CO_2 as were absorbed molecules of oxygen (and in the case of gases according to Avogadro's hypothesis, equal numbers of molecules make equal volumes at the same pressure and temperature); hence the respiratory quotient, $\frac{CO_2}{O_2}$, of grape sugar is 1.00. In the case of fats, however, substances less highly oxidized than sugars, but also completely burned in the animal body, relatively more oxygen will be required. With sugar, oxygen was required to oxidize the carbon only; with fats some is also required to oxydize the hydrogen. Therefore the respiratory quotient of fat will be below unity. As a matter of fact, it is .71. Proteins occupy an intermediate position, having a quotient of .81. Knowing the theoretical quotients, then, of carbohydrates, fats and proteins, and having obtained a subject's respiratory quotient by experiment, we can calculate how much of his total heat production is due to the combustion of carbohydrate, of fat and of protein.†

In addition to knowing the respiratory quotients of the three classes of foods, we also know their heats of combustion, and since they produce the same amount of heat when oxidized in the body as when burned in a retort, it has been possible to calculate the value in calories of a liter of oxygen for any respiratory quotient between .70 and 1.00.‡

Hence if we know the respiratory quotient and also the oxygen absorption, we can calculate the heat production thus:

Oxygen absorption per hour	×	Calorific value of oxygen for the R. Q.	=	Calories per hour

which, in case the oxygen absorption were 12 liters an hour, and the respiratory quotient were .85, would become

$$12 \times 4.863 = 58.4 \text{ calories per hour,}$$

4.863 being the calorific value of oxygen for a quotient of .85.

So much for methods of calculation. The next problem is in regard to what constitutes the normal metabolism and what factors may alter it. It is not my purpose in the present communication to discuss these questions, it is merely to point out their possible clinical importance. To answer the second question first, I may say that the taking of food, the doing of muscular work, and the exposure to cold, are the common factors which cause an increase in heat production in the normal individual. In the field of pathology, fever, acidosis and certain disturbances in internal secretions may also cause a rise.

Now it will be asked what constitutes the normal heat production, and is it a constant or a variable? It is very definitely a constant provided we use for comparison the minimum or, as it is more commonly called, the basal metabolism. By basal metabolism is meant the heat production when all the extraneous elements previously mentioned, food, muscular work, cold, etc., are eliminated. We can determine this basal metabolism in practice by having the subject at complete muscular rest, in the post-absorptive condition (that is, fourteen or more hours after food) and in an ordinarily warm room. If the effect of food, cold and muscular work are ruled out the metabolism will be found in any individual from day to day and from year to year (provided his weight remains the same) to vary very little. Further, it has been found that the metabolism of one organism is comparable with that of another, provided the total heat production of each is divided by the surface area of their bodies. This law was shown by Rubner to hold for all warm blood animals. Per unit of surface area, a mouse, a fowl and a man have the same basal metabolism.

Recently Du Bois[4] has made it possible to determine the surface area in man with great accuracy by means of calculations based on a number of linear measurements of the body. Using this formula, I have found the average basal metabolism of 16 normal men and women to be 38.8 calories per square meter an hour.[5]

This figure agrees quite closely with that obtained at the Sage Institute, and the average variation from it was only ±4%, and the extreme, less than ±10%. Following the Sage investigators, therefore, I shall consider any metabolism abnormal that is more than 10% from the average figure.

† In the case of proteins this statement is not strictly true, for proteins are not, like fats and carbohydrates, completely oxidized. To be absolutely accurate we should have to take the urinary nitrogen into account. For routine work, however, the protein metabolism may be disregarded since the R. Q. of the non-protein katabolism differs very little from that of the total.

‡ For these values see Williams, Riche and Lusk: Jour. Biol. Chem., Vol. xii, p. 357.

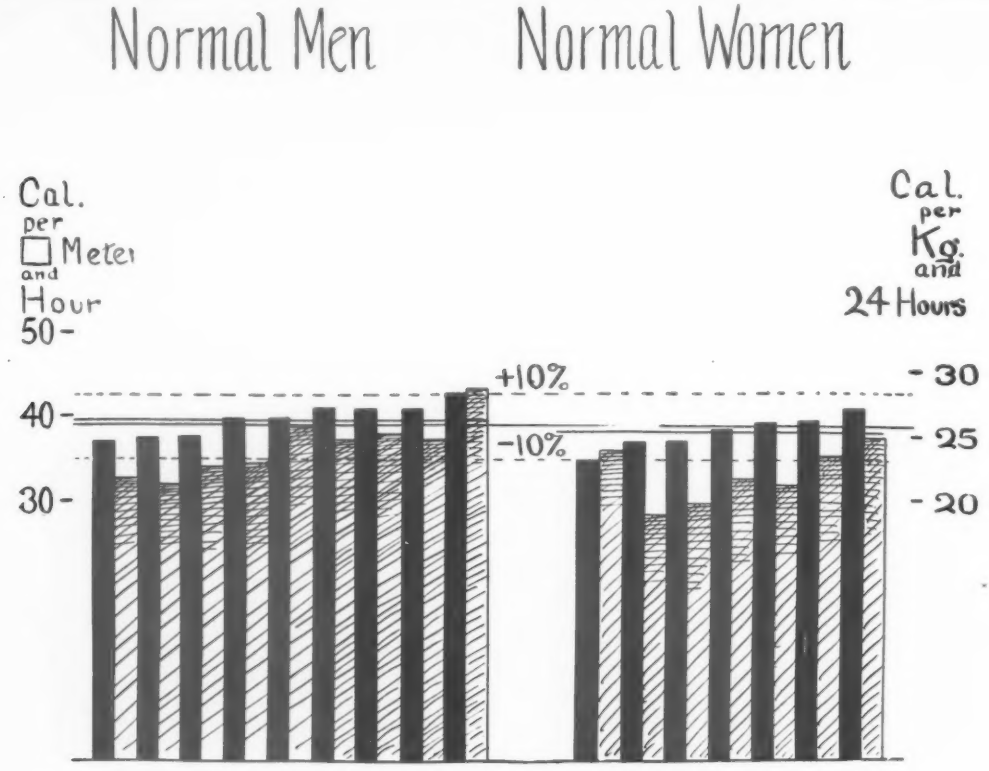

FIG. 1. The basal metabolism of a series of normal men and women. The black columns represent the metabolism per square meter and hour, the shaded columns, that per kilogram and 24 hours. The solid horizontal line represents the average of the series: the interrupted lines, a 10% variation above or below the average. The subsequent diagrams are all constructed on the same plan as this one. The base line in each case is zero, so that the height of the columns indicates the actual amount of heat production.

That the metabolism is more nearly proportional to the surface area than to the body weight will be seen by a glance at Fig. 1. The black columns representing the metabolism per square meter, are more nearly the same height than the shaded, which represent that per kilogram of body weight. This fact becomes more striking in Fig. 2, where the metabolism of two very fat women is contrasted with that of a woman of normal build, and a rather thin man. The four black columns representing the surface area relation are all within 10% of the average, whereas the shaded columns representing the weight relation are, in the case of the fat subjects, 40-45% below the average.

It may now be asked of what interest is all this to the internist. A little consideration will make it apparent that it is of very distinct interest. No one will deny the importance of the body temperature, of the pulse, or the blood pressure, yet about the only information we get from the last of these is that if constantly elevated the patient probably has chronic nephritis, or arteriosclerosis, or both, facts that we could probably arrive at by other means.

In the basal metabolism we are dealing with a factor nearly as constant as the body temperature, and because of the light it throws upon the calorific requirements of the body, quite as interesting.

For example, the basal metabolism of a 60-kg. man might be 1,500 calories a day. This would be his heat production if he lay quietly in a warm room all the twenty-four hours. When he leads a life of moderate activity this may become 3,000 to 4,000 calories. Now in severe Graves' disease the basal metabolism may be doubled, so that the same man if he had that malady might have a basal metabolism of 3,000 calories and an actual metabolism very much higher. This at once shows that in order to keep patients with this disease in equilibrium they must be fed very many more calories than a normal individual of similar size and under like circumstances. The same applies in typhoid fever as shown by Coleman and Du Bois [6] and hence the advantage of their high calory diet.

During the past two years I have had an opportunity to make various studies of the basal metabolism in the medical wards of the Massachusetts General Hospital. The apparatus used for the oxygen and carbon dioxide determinations was that of Benedict.[7] After a series of normal individuals had been secured the work lay chiefly in a study of thyroid disease and of obesity.

Thyroid cases are particularly interesting since in hyperthyroidism there is a marked rise, and in hypothyroidism a marked fall, in the basal metabolism. In Fig. 3 are shown a series of nine cases of typical exophthalmic goitre. The metabolism in all of them shows a marked rise,

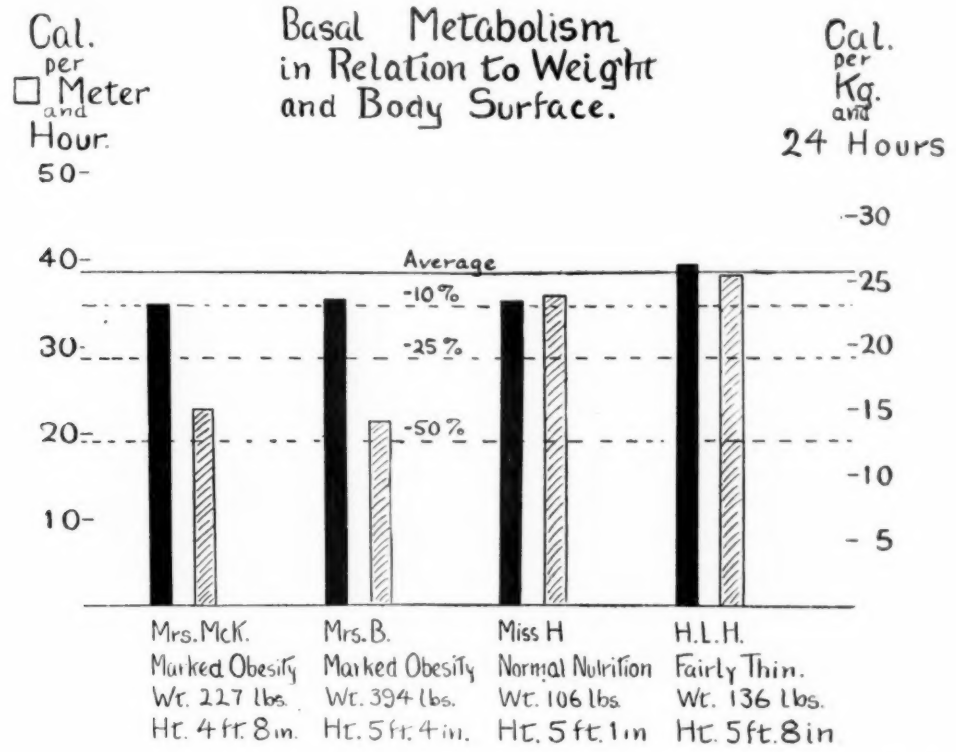

FIG. 2. The basal metabolism in obese and normal subjects, showing the close relationship of the metabolism per unit of body surface and the wide divergence of that per unit of body weight.

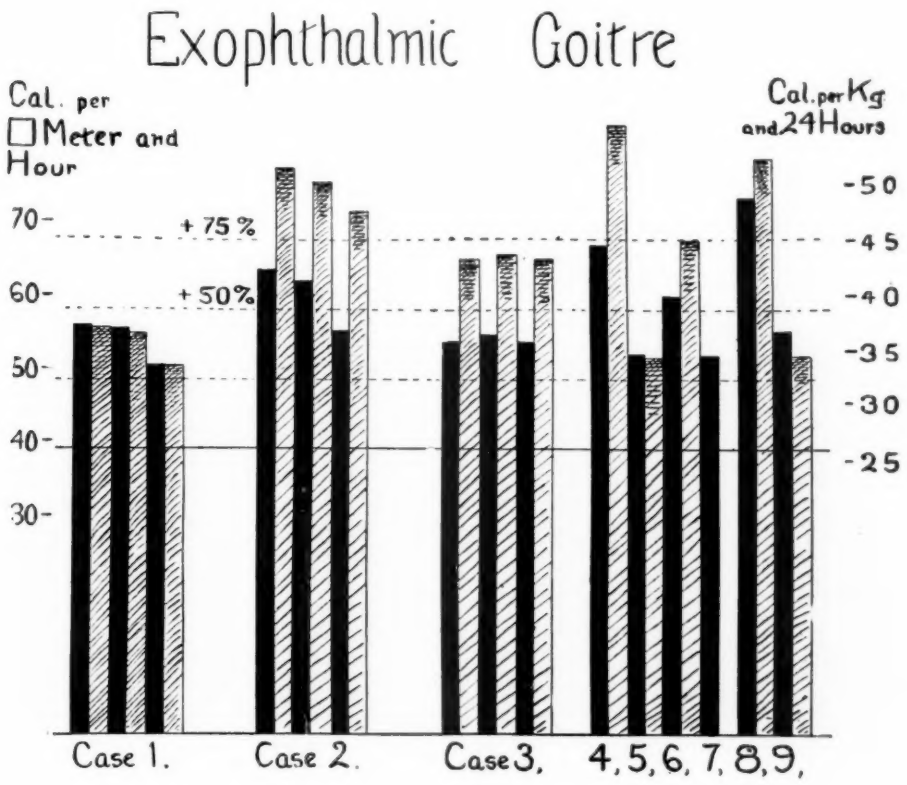

FIG. 3. Basal metabolism in Graves' disease. The third column in Case 1 was after one x-ray treatment, and the third in Case 2 was after hemithyroidectomy.

anywhere from 30% to 80% per square meter, and still more per kilogram, this latter being due to the great emaciation that many of them show.

This marked rise in hyperthyroidism is very interesting because, so far as is known, so marked a rise occurs in no other condition in which fever is not present. These patients were all afebrile when studied. A slight rise in the metabolism may occur in acidosis, that of diabetes or of uremia, for example, but it seems likely that a marked rise (50% or more) may be used as factor in the differential diagnosis of hyperthyroidism.* Early Graves' disease is sometimes confused with early phthisis. I have not as yet been able to make any determination on the latter, but one advanced cases of phthisis that I observed showed a normal metabolism.

In addition to the fact that an increased heat production is a characteristic of hyperthyroidism, there seems to be good evidence that the severer the intoxication the higher the metabolism.

Case 1, a middle-aged woman, on whom three observations are reported, was a very severe case with all the classical signs of Graves' disease, marked tachycardia, tremor, nervousness and eye signs. The third observation was about three weeks after the first, and during the interim she had been on the hydrobromide of quinine and in addition had received one x-ray treatment. A moderate fall in the metabolism had occurred.

In Case 2, also a severe one, the first two observations were made before treatment was instituted and the last three weeks after a hemithyroidectomy. Here, again, the metabolism decreased somewhat. In both cases the fall was coincident with subjective and objective improvement.

The three observations on Case 3 extended over a period of five weeks, during which time she was getting x-ray treatment. No fall in the metabolism took place, though clinically she was better. She was not so ill at the start as Cases 1 and 2.

Case 4 was a very advanced and malignant type with great emaciation, who later died following ligation of the thyroid arteries.

Case 8 was an early case with only slight tachycardia and eye signs, but with extreme nervousness and definite thyroid enlargement.

Cases 5, 6, 7 and 9 were all moderately severe cases, none of whom had had any treatment when the determinations were made. Of these Case 5 deserves comment because she had had Graves' disease seven years before but had apparently been cured by hemithyroidectomy followed by x-ray treatments. A few months before my observation was made, symptoms of Graves' disease had returned and at the time of examination there was marked enlargement of the remaining half of the thyroid, with bruit, eye signs, tremor, tachycardia and nervousness.

Reference to Fig. 4 will show that in myx-

* A slight rise in the metabolism, so Dr. Du Bois writes me, occurs in such conditions as acromegaly, dyspnoea, anaemia, and cancer, but these conditions can easily be differentiated from hyperthyroidism.

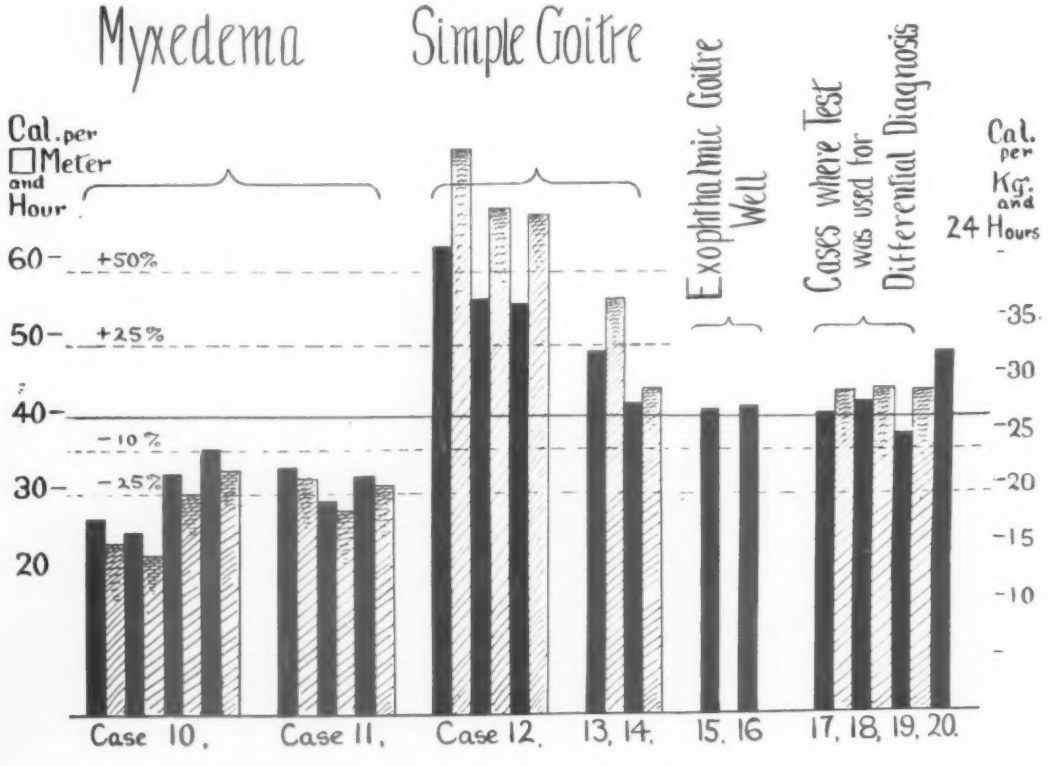

FIG. 4. Myxedema and atypical thyroid cases.

edema the metabolism shows the reverse change to that found in hyperthyroidism. Cases 10 and 11, both typical myxedema, who had never taken thyroid gland, showed a marked reduction. The last two columns in Case 10 were after thyroid administration had been begun and show a tendency for the metabolism to increase toward normal.

Case 12 was a patient with a large cystic goitre of long standing, who recently had begun to have symptoms of hyperthyroidism, tachycardia, tremor, nervousness, etc., but no eye signs. The high metabolism found makes it seem certain that she actually did have some hyperthyroidism.

Cases 15 and 16 had both had typical Graves' disease in the past, but were completely recovered when observed; both showed a normal metabolism.

Cases 17 to 20 were obscure cases where hypo- or hyperthyroidism was suspected and the test was done as a means of differential diagnosis.

Case 20 was a tachycardia of unknown origin. Electro-cardiography pointed toward a cause outside the heart, and that, together with the increased metabolism and nervousness, led us to consider it a case of hyperthyroidism, even though typical signs were lacking.†

The second group of cases that I have given most attention to is that of obesity. In Fig. 5 the results obtained in ten cases are shown.‡

At this point I must mention the fact that with increasing years the metabolism gradually declines[8] so that it is not fair to compare the metabolism of a person of fifty years with my average figure of 38.8 which was obtained from a series of persons between twenty and thirty. Some of the obese subjects were well over thirty (Cases 21, 23 and 25) and for them 35 calories per square meter and hour would be a fairer standard than 38.8. Using 35 calories as a standard, then, it will be found that Cases 21, 23 and 25, all of whom were enormously obese, were well within 10% of the standard. In Case 22 some of the observations fall slightly below the —10% line. So also do Cases 24 and 26, but not nearly to so marked a degree as the two cases of myxedema. Cases 27 to 30, which comprise all the men, are within 10% of the normal. In Cases 24 and 26 there was some clinical evidence that a disturbance of internal secretion was present. Neither of these cases would be considered more than moderately obese in comparison with Nos. 21, 22, 23 and 25.

A few miscellaneous cases were collected. One of Addison's disease, one of myasthenia gravis, one of Raynaud's disease all showed a normal figure. A case of pernicious anemia with a hemoglobin of 50%, also showed a normal metabolism. In pernicious anemia with a lower blood picture, Meyer and Du Bois have found a slight increase due, they think, to an increased blood flow and utilization of blood oxygen.

In regard to the kind of katabolism in these various conditions, as shown by the respiratory quotient, we cannot say a great deal. Benedict[9] has shown that the *nüchtern* quotient in man is influenced to a marked degree by the amount of carbohydrate in the previous diet. As in the majority of these cases the diet was not measured we can draw no definite deductions.

In conclusion I should like to emphasize the following points:

1. Basal metabolism can be readily studied

† These thyroid cases will all be published in full in a subsequent paper.

‡ Of these ten, Cases 21, 24, 25 have been published. (See Means, J. H., Jour. Med. Res., Vol. xxxii, p. 121, 1915.) The others will be published in detail in the near future.

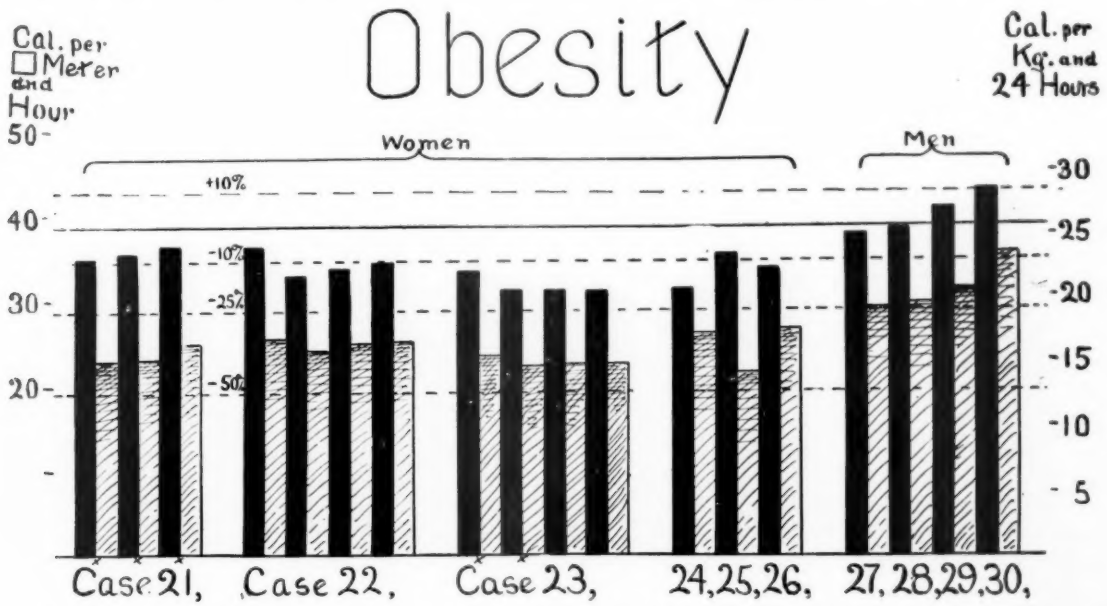

Fig. 5. Basal metabolism in obesity. Cases 21, 23 and 25 being considerably older than the subjects in the normal series, it is probable that for a standard we should take 35 calories per square meter and hour, which would make them lie within 10% of the normal, as explained in the text.

in a hospital clinic with comparatively inexpensive apparatus.

2. The normal basal metabolism is a fairly constant affair, and hence wide variations from it in disease are of interest to the clinician.

3. A marked rise occurs in hyperthyroidism.

4. A marked fall occurs in hypothyroidism.

5. In regard to hyperthyroidism it seems probable that the basal metabolism furnishes

(*a*) The best index as to the severity of the disease, and hence is a quantitative means of following the course and of judging of the effectiveness of treatment; and

(*b*) A valuable aid in differential diagnosis.

6. Enormous grades of obesity are possible in the presence of a normal basal metabolism.

7. When a reduction in the metabolism was found in obese subjects there was also clinical evidence of defective internal secretion.

8. A clearer conception of the food requirements in disease is furnished by the basal metabolism than by any other factor.

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THE PHYSICIAN AND THE PREVENTION OF INDUSTRIAL ACCIDENTS.

BY HERBERT J. CRONIN, M.D., CAMBRIDGE, MASS.

WITH horror we read tales of the jungle where the wild beast leaps from his lair, seizes a human victim, and slowly devours him in spite of his futile efforts to escape. Mentally we picture his struggles to avoid the pitiless jaws, hear the crunching of bones and the weakening cries for help. Our imagination is fired and we fancy ourselves shooting the beast and rescuing the unfortunate. Then, it is dismissed from our minds as merely fiction,—such things do not happen nowdays. Yet almost daily in this country a workman will be seized by a huge machine and drawn into its cruel crushing gears. It is more powerful, merciless and destructive than the beast; it quickly kills or horribly mutilates. A campaign is being waged for the protection of our workmen from such disasters. It was first brought to the attention of the public by the Saftey First slogans. Accident prevention in industries is now a topic of first importance; yet the medical profession has not been actively enlisted in this campaign nor has there been an organized effort to interest them.

Until the passage of the Workmen's Compensation Acts, accident prevention was given little consideration. Labor was cheap,, and if a man was injured, it caused but an expression of passing regret or sympathy; he was dropped from the payroll and another filled his place. He was allowed to seek his own help; the business that caused his injury had no interest in him. Labor was scrapped in the same way as the machines it worked upon. We had a superabundance of foreign labor, which has been one of America's greatest assets; it has done the hard, laborious work of the country and our mines, steel factories and mills have depended upon it. It is fortunate that we have started this campaign

FIG. 1. Shows how a boy's arm was lost on a mule-spinning frame.

to conserve labor, for it is doubtful if we shall receive many men from Europe after the war. They will be kept home to build up their devastated countries.

For years plants have taken precaution against fire. They have had local fire organizations, apparatus, sprinklers and other safeguards. They were proud of their efforts because they not only protected the plant from destruction by fire but helped to reduce the fire insurance rates. Yet the same firms did nothing to safe-guard the lives of employees from death-dealing machinery. Employees were expected to look after themselves and it was their own loss if they were injured. If the machine was dangerous to operate, they must use all due care: but no attempts were made to make a dangerous machine safe until the advent of the Compensation Laws. Now the costs of the hazards of an industry are charged up to that industry. Many accidents mean increased premiums. It is business policy to try to prevent accidents and place

safe-guards on machinery. The act has brought about an almost socialistic tendency on the part of some employers. For the first time they are thinking how the employee lives when not at work; for it is obvious that if he does not get enough food to eat, is unable to support his family, home conditions are bad or that he is in debt, he will not be able to do good work and will also be more liable to injury. This act is the most advanced piece of social legislation in modern times. It has brought about the application of practical Christianity to industrial labor and at last, man is more than mere material that can be cast aside without thought.

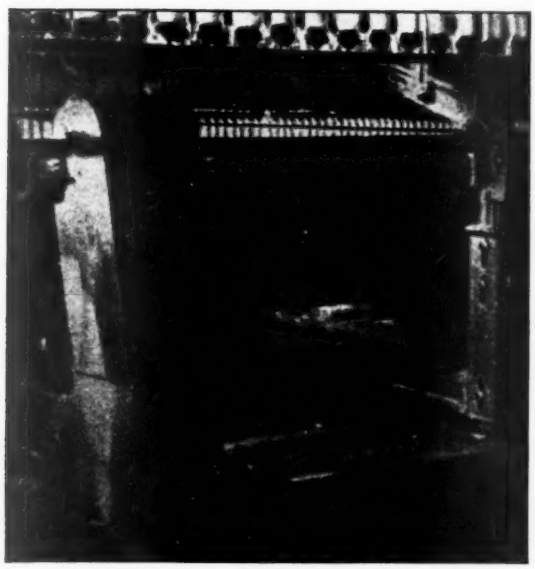


FIG. 2.—Illustrates same spinning frame, shown in Fig. 1 with a guard in place. (1915 report of Massachusetts Industrial Accident Board).

The physician can do much to assist this campaign. He sees the accident first, dresses it and has the patient under his care. He can get a true history of how it occurred, look into the physical condition of the patient and decide for himself from the injury how it may have been caused. The recurring cases will be strongly brought to his attention. Our youngest interne at any of the metropolitan hospitals quickly recognizes by their frequent recurrence the causes of the common traumatisms; he knows the crush from the printing press, the mangling by gears, the buzz-saw fingers, and burns from molten metals. The doctor can inspect the site of the accident before the real cause of the injury, such as an oily floor or broken board, is removed. Most of the large plants have a physician in constant attendance. In the smaller plants that send their accidents to the hospitals and have no physician in their employ, the family physician of the manufacturer can draw his attention to these reforms and advise him in this respect. Technical knowledge is not necessary in giving advice for the correction of a large percentage of accidents. It is merely good common sense. It requires little more ability than is demanded of the ordinary inspector of a Board of Health; for so many accidents are caused by such simple things as obstructions, unguarded pits or floor-openings. We do not expect that a physician will design intricate guards for gears or belts. But he can see the need of such a guard and advise the manufacturer of it. He need do but a little reading and then observe men at work and he will have a working knowledge of this subject and be able to be a big factor in the campaign.

There are many common, well-known principles that apply to accident prevention in most mills or factories. It is best that all guards should be made of steel or cast iron, for the wooden ones become oil-soaked and add to the fire hazard as well as not giving the best protection. When a man gets caught in a machine, it is first necessary to shut off the power; for this purpose, every department should have some arrangement situated at convenient stations so that the power can be quickly stopped. In order that the employees will not lose their heads when an accident does occur, frequent drills should be held on the method of stopping the power.

Belts are a daily cause of serious accidents. Men are caught and whirled around shafting or crushed on the drums; women have had their hair entangled and have been scalped. If a belt creeps from the loose to the tight pulley, the machine is unexpectedly started, with serious results. Belts can be completely guarded by various inventions and with the use of belt-locking devices on the belt shifters, the moving belt accident can be prevented.

Moving shafting can be enclosed in pipes or other suitable enclosures. Set screws on these moving exposed parts can be sunk below the shaft surface. A solid collar or any of the various safety screws can be used. When a man gets his foot caught on a set screw, the injury, although not fatal, is mutilating and incapacitating.

All inward revolving gears should always be protected, and can be so, without interfering with the efficiency of the machine or operator. Most of the new machines are built equipped with the proper guards. During the process of construction it is easy to build the guards into the machine, and the manufacturers should demand that type of machine. Most of the old machines with gears are still unprotected.

Portable ladders are a fertile field for accidents. Whenever possible, fixed ladders should be used and this is particularly so in boiler rooms. If portable ones must be used, let them be equipped with spikes, spurs or rubber shoes. The necessity for orderliness in packing supplies and the removal of all obstructions in passageways that might cause one to fall seem only too obvious. Likewise, it seems plain that stairs should have a handrail and that treads should

be of some non-slipping substance; that floors should have no loose or broken boards and that all openings as well as hatchways be guarded by a rail of sufficient height.

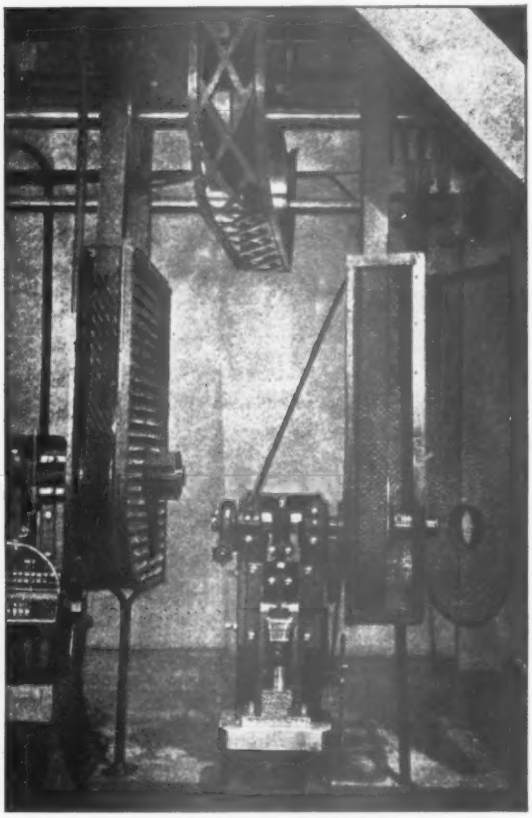


FIG. 3. On the right, a small bench press with drive belt and pulleys enclosed. Side of the guard is so hinged that it may be opened. The press is equipped with a non-repeating safety type clutch. On the left is another press with belt and pulley guarded. Note the manner in which the overhead horizontal belt is guarded. (1915 report of Massachusetts Industrial Accident Board.)

The edge of a hammer or drill becomes easily mushroomed by constant use and these particles fly off, causing serious eye injury. Slight attention to the truing-up of these tools can prevent this. In other trades where flying particles are difficult to prevent, such as work on the emery-wheel or the pouring of molten metals, men should be compelled to wear goggles. If the manufacturer provides these at his own expense, there will be no excuse for not using them.

Freight elevator accidents are generally fatal or terribly mutilating. The common type of freight elevator is merely a platform without guards of any kind; its power control difficult and slow to operate. The elevator shaft is guarded by a cross-bar or improvised gate that is but a slight protection. Hence it is not surprising that so many night watchmen are found dead at the bottom of these shafts after stumbling over the gate in the dark. Although it is strictly forbidden by most employers that their boys operate or ride on the freight elevator, yet young people just out of school will attempt to run the elevator when no one is around. They hop on and off the moving machine, put their heads out in the shaft to watch the elevator descend and play about the open pit. And then comes a news item of the fire department called to chop out some youngster who has been caught between the wall and the elevator, or more often, just a line announcing the fatality. Freight elevators can be just as well protected as a passenger one without impairing their efficiency. Proper gates can be put about the pit and the sides of the machine adequately guarded.

Insufficient lighting is a fruitful source of accidents and until recently has almost been ignored. In plants that work a day and a night shift, the proportion of accidents at night on the same work is larger than during the day, and this is explained largely by improper lighting. Sometimes machinery is adequately illuminated but the passes are dark, and when one goes from brightness to total darkness, is it surprising that he should fall down stairs or over hatchways? The modern factory has recognized these essentials and is almost as bright as a photographer's studio; the old solid brick construction with its few windows has been replaced by sides of glass. But even with all this daylight, huge machines with their belting will cast shadows. To correct this, the inside of the factory should be white in order to reflect all the light. White-wash becomes dirty quickly and is unsatisfactory, but the white enamel paints are giving good results. If artificial light is used, it is often improperly placed and causes eye-strain and other eye troubles, with the result that the men do not see well and accidents occur in the same manner as with insufficient light. It is needless to dwell on the necessity for proper ventilation which will take off the dust, poisonous gases and protect the employee's general health.

After all the practical devices have been put on machines, it has been shown that only about 35% of accidents can be so prevented. In order to supplement the work, every plant should start a safety organization among its employees. The general plan of such an organization is simple and easily carried out; but the heads of the plant must take an active interest in it and its policy, for if they allow dangerous and careless practices, the employees will do likewise. A safety organization can be started without increasing the pay-roll, for the work should not interfere with the employee's regular duties except in large plants where one employee is designated to be a safety inspector and spends his entire time at that work.

A simple plan for a safety organization is first to appoint a man of good judgment to be safety inspector and to work under the direction of the manager or superintendent. He can take charge of the routine work such as the safeguards on the machines, sufficient lighting, fire precautions, arrangement of materials in a safe manner, watch for careless and unsafe practices,

and report all serious accidents to the management. Next there should be a permanent safety committee, to be made up of, for instance, the chief engineer, shop foreman, and the chief mechanic. They should work in conjunction with the inspector, and pass on all his recommendations as an advisory committee, look into the cause of all accidents, and consider how they can be prevented. Finally and most important of all, a workman should be selected from each department to act as a general workman's committee. These men should be changed every month and in that time should make two general inspections of the plant. They will also look into all accidents in their own department and report them both to the advisory committee and the safety inspector. This will create an active interest in the men themselves who are the ones that have the accidents. They could also take up the instruction of new men who are put on dangerous machines, and by telling the dangers to the new man in his own language, prevent that common farce of English notices of warning or caution placed on machines, and expected to be read by an employee who cannot understand a word of English! A doctor should also be a member of this committee as medical advisor. The employees always have confidence in a doctor, for they know that he is working for their interests.

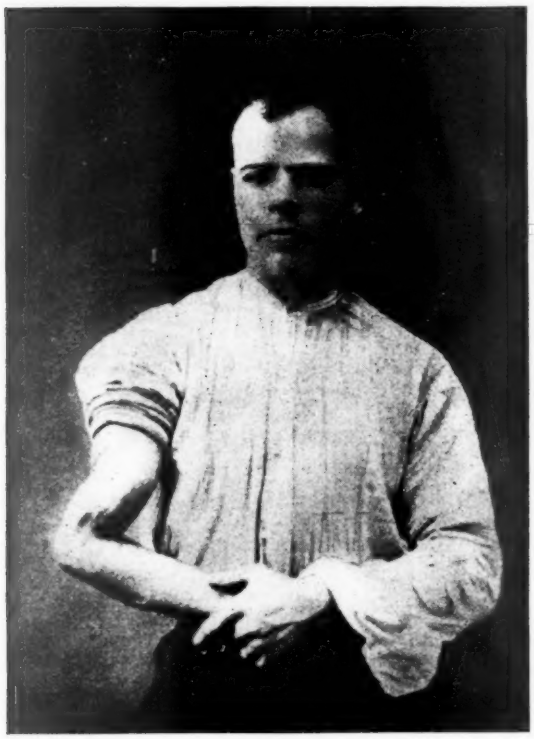


FIG. 4.—An inexperienced workman who got his hand caught in a gear. He has a real permanent injury. (1915 report of Massachusetts Industrial Accident Board.)

The by-products of industrial warfare are worse than those of real warfare. The soldier is given a pension and aided by the government. What of the injured steel worker or miner? In the past, if an industrial worker lost a leg, he was discharged from the hospital with a hopeless future; no job, few opportunities for a crippled workman and no money to get an artificial leg that was efficient. He became a wreck of our industrial warfare and usually drifted into an almshouse. Little consideration was given to the fact that he could be re-educated in his trade. Even the medical profession did not know the full possibilities of artificial limbs. With the advent of the Workmen's Compensation Act, there is a new stimulus to get these men back to work; for, if a man is not totally disabled and can do part of his former work or some other work, it will not be necessary to pay him total disability rates and that means lower premiums, as well as an application of Christian charity. In Europe today they are attempting to turn back the disabled soldier of war into a competent soldier of industry. Strange new schools are starting in which these men are learning to use their shattered bodies in useful occupations. Now with the aid of artificial limbs, the men are taught again what they formerly knew how to do, and are not total losses. The modern artificial limb is a marvelous piece of mechanism. With it armless and legless men are able to use delicate tools, climb ladders, and even play on musical instruments. Let us

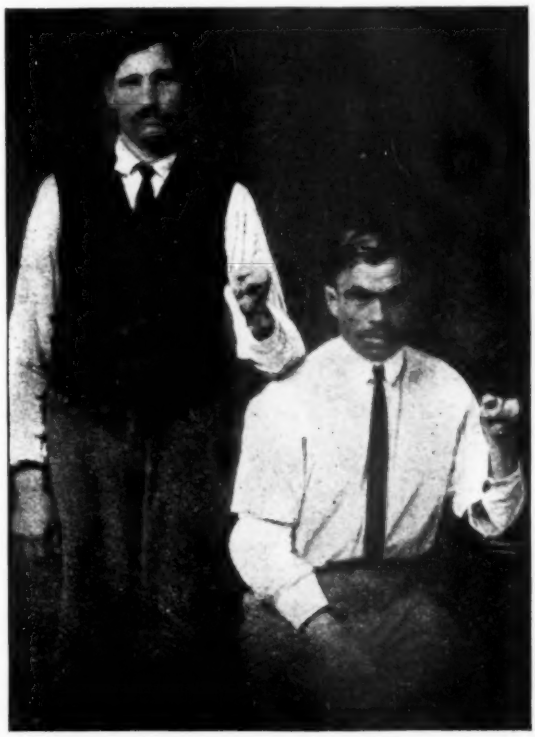


FIG. 5.—Two Russian workers who received identical injuries in the same year and in the employ of the same firm. They could not understand English, yet the report of the accident states that "he took his feet off the safety treadle contrary to our *rules* and instructions." They were feeding an embossing machine, and in an endeavor to straighten out the skin that was being embossed, put the left hand into the machine between the plates while it was in operation and with the above results. (1914 report of the Massachusetts Industrial Accident Board.)

do the same with men injured in our industries, and let the medical profession act as pioneers in this new work as they have in nearly every other social reform.

Memorial Address.

BENJAMIN E. COTTING, M.D.*

BY H. WARREN WHITE, M.D., BOSTON.

WITH real pleasure I accepted this part of saying a few words concerning Dr. Cotting, for which honor the time allotted is all too short, yet it gives me a little opportunity to show my deep appreciation of his many personal kindnesses to me, and a chance for us to pay a little tribute to one of *our fathers* in medicine. Virgil's first line in the Æneid comes to my mind, "Arms and the man I sing, who first," etc. Oh, that I might sing from a full heart what I really feel we all owe tonight to this good physician who, amongst the first, placed such a high value on the *social* friendship of his confrères! Benjamin Eddy Cotting was the real *pater noster* of our Society. At a time when fierce rivalry, petty jealousies and false charges between members of the medical profession induced enmity and spite, when doctors manoeuvred to steal each other's patients, and when successful, theatrically pitched their predecessor's medicine out of the window,—this quiet, clerical-looking gentleman played the game fair and prospered exceedingly. Those were the days when, if a patient died, the doctor claimed he had not been called early enough, and, if he lived, he had been snatched from a deep, deep grave! At such a time our friend stoutly maintained that disease was generally self-limited, a part of the very plan of Creation, and that the real truth was, that the doctor hadn't done half so much towards the cure as the optimistic physician imagined he had done.

One of the great difficulties in the advance of medical science has been, that once a doctor has grasped and accepted certain ideas concerning disease, that belief easily becomes fixed and that possessor becomes a champion or defender of that faith. If real truth did not agree with such faith, so much the worse for real truth. Now, while Dr. Cotting was controversial and enjoyed a wordy war, as we look back upon those early days, we perceive that he fortunately was more nearly *right* as we see the truth today. The spirit of the times was more combative then than now, and while our friend, because of his aggressive attitude and open skepticism, was considered almost an enemy of the family physician (as some others are today), he really was endeavoring to clarify Truth by viewing her from all sides and every angle. He possessed the heroic attitude of willingness to follow Truth, let her lead him where she would. So in those days while our founder was so ready to pitch into the hot argument, none was so ready as he to furnish the hot oysters, and to calm discussion with the cooling punch, and with most solicitous attentions heap confusion on the heads of his antagonists. A reader's paper never lacked discussion then as is so often the case today. It was ofttimes torn to shreds (figuratively) by furious attacks—attacks that included the writer as well as his paper.

Benjamin E. Cotting has been dead nearly twenty years. He would be 104 if alive now. When I first met him thirty-five years ago he was already sixty-nine years old,—a dignified ministerial old man full of years and honors. The rather frail, diminutive red-headed son of an Arlington baker had become most widely and favorably known as a scholar and philanthropist, a successful physician loaded with the highest of local honors! He had been secretary of the Massachusetts Medical Society. Later, when sixty-two years old, its vice-president, and then president. He had reorganized its methods, written its code of ethics, been influential in having committees appointed to see such code carried out officially and with dignity.

Thrice has our little Society been honored by its members becoming presidents of the Massachusetts Medical Society, viz: B. E. Cotting, G. W. Gay, and C. F. Withington.

Dr. Cotting was the *pater noster* of other societies than ours, notably the Obstetrical Society of Boston. He had with others purchased the BOSTON MEDICAL AND SURGICAL JOURNAL and for a while was its editor. He rescued that from a most painful and sickly career. He was consulting physician to Boston City Hospital, honorary member of other state societies and corresponding member of the Royal Medical Societies of Greece and Italy; a Fellow of American Academy of Arts and Sciences. Enthusiastic in his love for science and medicine, it was said of him that the Massachusetts Medical Society was indeed his very religion.

After graduating from Harvard College (A.M.) at twenty-two years of age, he taught school and scrupulously paid back, to his father, moneys that had been advanced him for his education. Later he refused his portion of the family estate, asking that it be given to the others more needy than himself. He told us a story of those early days of school teaching. In his school was a refractory pupil fully as large as, if not larger than himself. He deserved a flogging, but considering his size, it was doubtful if Benjamin could do it. He tackled the big bully and whipped him and whipped him as long as he was able; then as the humor of the situation came over our young teacher, he could not help bursting out into a hearty laugh. Later he

* Read at the Fiftieth Anniversary of the Roxbury Medical Improvement Society at Young's Hotel, May 25, 1916.

heard this pupil blubbering under the schoolhouse window—"Darned old red head, darned old red head, he licked me and then—and then he laughed at me!"

At twenty-five he graduated from the Medical School and settled in a small bare room, corner of Washington and Bedford Streets, in the year 1837. Here, and later on Winter Street, he starved along for about five years; picking up night calls, doing work for others in summer time, and finally becoming assistant curator of the famous Lowell Institute Lectures in 1841. This position influenced the whole course of his life greatly. It gave him the acquaintance of the rich Lowell family with its wide financial interests and probably did much towards the accumulation of his own fortune, through favorable investments in the valuable mill stocks of that period. Finally the opportunity he waited for offered itself in Roxbury. He had never intended to settle permanently in Boston.

Here Dr. Cotting lived in a cottage house (next to the Norfolk House) of very modest proportions—a house to which he repeatedly invited his friends and associates. His fifty-five years as curator of the Lowell Institute Lectures gave him a wide-spread acquaintance with notable scientists. Prof. Gould, Jeffry Wyman, and Prof. Louis Agassiz, at one of their meetings at this house, in sport, gave this cottage its pseudo-Greek name κωσικάββυν, Kosy Kabbin, or, as he called it for short, the K.K. In this little house chloroform was first administered in America, and later they marvelled that their ignorant experiments fortunately did not prove fatal to some one. In this cottage was the birthplace of this Society fifty years ago, and the generous refreshments, provided by Dr. Cotting, contributed quite largely to the happy fellowship in science, a part he felt was as important almost as the scientific papers themselves.

Polite and most genial, Dr. Cotting never seemed at his very best, as when that little house was *filled* with his friends. Scholarly, witty, skeptical, and sometimes keenly sarcastic, he himself was the centre of every such gathering. The doctor had had a large experience in practice,—he had had the cream of society practice in those days,—his hospitality was exceedingly generous, his beneficences many, and such as his means justified, as shown by many public gifts that were well known, as well as by many more that were heard about only after his death. He was scholarly, graduating with honors; a P. B. K. man, and a European traveller. He crossed the Atlantic many times when such journeys meant serious effort and dangers compared to the present days. Dr. Cotting and his wife went with Louis Agassiz and his wife on a semi-scientific trip to Brazil, returning to America via Southampton, England. When Dom Pedro came to this country he stopped at the Kosy Kabbin, and in memory, Dr. Cotting named his old white horse "Dom Pedro Secundus." He was a good talker and story teller and had a mind stored with wide information. He enjoyed a patient listener and to such he poured forth prodigally from his rich storehouse. Age never soured him—a most *delightful* "grand old man!" He came of a delicate tubercular family. He had the spare frame and fine face of a sensitive gentleman; his everyday ministerial Prince Albert coat, and even more his habit of always wearing "barn door pants" (much affected by the clergy of that period), made him a figure, with his long white hair of late life, one would never forget. While this Scientific Society celebrates this unusual occasion, let me appeal to your sentiment. I wish that more of our Society might have met on the old empty lot as some of us did before coming to our dinner tonight, in memory of the Kosy Kabbin and its former occupants. Here was the former centre of old Roxbury when Roxbury was only a country suburb of Boston. Dr. Cotting said there were just six physicians in regular practice when he came here to settle. At that time there were no curbstones, and sidewalks were merely earth paths along the travelled way. The streets were generally not lighted at night,—never when a moon was expected to shine,—and lanterns were carried by most pedestrians. South of Dover Street there were only a few houses. Tremont Street was a mere road, but little raised above the salt marsh, with only one house on it. There were few chance posts to hitch your horse and so amongst the first, if not the very first, Dr. Cotting adopted the horse weight with strap and snap, a great convenience. At that time Roxbury had less than nine thousand inhabitants, and in time, from the center of Boston, was about as far as Worcester is now. Dr. Cotting built up a large practice, and in spite of his benevolent methods, when he died his estate was worth a good round sum. He worked hard and gave freely. He boasted of making as many as forty-three visits in one day from early dawn to late night; of attending four births in different parts of the town in twelve hours, three male and one female, and as it was the 22d of February, the boys were all called George Washington and the girl Martha. In one year he treated, he said, three hundred and seven cases of typhus fever, a malignant epidemic of that type coming to Boston at that time. For fifteen years Dr. Cotting was trustee of the Roxbury Latin School and on a building committee with one other, completed what is now the present building on Kearsarge Avenue and, *mirabile dictu*, within the time and *appropriation* set, which fact he ever related with great pride.

He enjoyed the rôle of being a father in medicine to the young practitioner. One time an absurd story was started but soon cut short. It was reported around that Dr. Cotting always gave to a newcomer a horse or vehicle. It had some foundation inasmuch as he had given to three young practitioners one or the other of

these articles, rather worn perhaps, but with several years' good service still remaining in them. He had loaned money, paid rents as well as transferred families completely to these young doctors, remarking to the family, "Now, if anything serious takes place or you're afraid and affairs are going badly, I'll come in and be shoulders for this young man any time!" To me he admitted such favors were not always appreciated, for he minded the old saying, unfortunately true sometimes, "If you wish to make a man your enemy, do him a favor." His door was always open to these young medical friends, the only children he ever had, and such interviews were very profitable. He was a stickler for the fine points of professional etiquette and expected it from others. He would weigh with great nicety the pros and cons of a situation and was a most excellent umpire. A skeptic naturally by disposition, yet he was a most practical Christian in brotherly love. His faith was small, his bump of charity exceedingly overgrown, even almost to *deformity*. He was a real Nihilist as regards medicines, excepting only about three or four drugs. He was a good diagnostician and had a real gift in mechanics. He surely disapproved of *women* doctors and heartily *hated* the sight of a homeopath! His painstaking in little things was well illustrated by his insistence on his method of treating ingrowing toe nail, the radical cure of which his methods insure today.

Dr. Cotting told stories on himself with great enjoyment, a sample of which I must relate just now: As a large, full omnibus left its station in Eliot Square one day, a pompous self-constituted boss sat at the head of it. Overhearing a passenger at the other end of the vehicle relating how a Dr. Cotting had attended a recent fractured thigh, he shouted in a rough voice, "Who d'you say attended them?" On being answered "Dr. Cotting," the bully again exclaimed, "Dr. Cotting, Dr. Cotting, who *in hell* is he?" Dr. Cotting adds quaintly, "I took occasion at the first opportunity to render gratuitous service to that man's family, that he might recognize me as one of his neighbors; call the *place* in which we lived by whatever name he chose!"

I shall forever remember the hot debates he had with Dr. Henry Martin (his Dudley Street neighbor). These were at the Norfolk District Medical Society meetings. Dr. Martin was big, pompous and blustering, red-faced and apoplectic when exasperated. Dr. Cotting, thin, a trifle more pale, keenly sarcastic but triumphant in such wordy controversy. Our doctor, with great glee, would rise on such occasions to wonderful acuteness. Nothing he liked better than to smother brag and bluster with delightful wit. Like an expert swordsman he had chopped off the opponent's head without his being conscious almost of his defeat. He did like an argument, and enjoyed the game immensely.

He never kept office hours, preferring to preserve his home as private and quiet as possible. His little house was filled with mementos of his long and successful career. All his life he exalted friendship and illustrated the value of making more friends rather than more money. He lived the motto of our Society, "Scientiae et Amicitiae." If medicine was *his* mother, so she is *our* mother too. Dr. Cotting was our most worthy father, of whom tonight we may well be proud! Science for our mother, Dr. Cotting for our father, "Kosy Kabbin"—the womb from which we sprung. Our pedigree then is complete. Let his life here be one of our cherished traditions! For a score of years Dr. Cotting's body lies *a mouldering in the grave*, but quite reverently I hail his most friendly spirit, which, in the fellowship of this Club he founded, still goes *a marching on!*

Clinical Department.

TWO CASES OF SYPHILIS OF THE LUNG.

BY ARNER POST, M.D., BOSTON.

THESE cases of syphilitic disease of the lung are too valuable to be allowed to lie unpublished, even if the histories lack something in completeness.

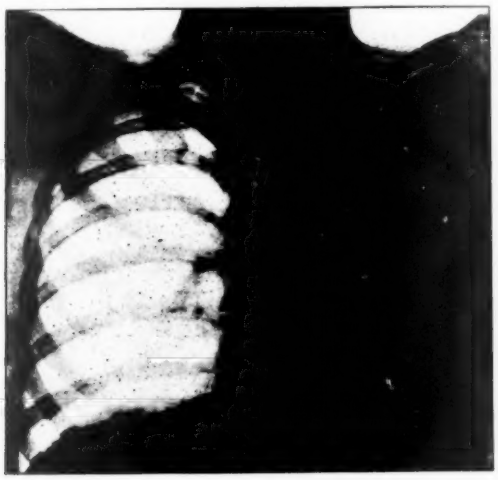
CASE 1 began as a primary sore of the lip, first seen on May 9, 1908. That was followed in due time by very severe constitutional symptoms, which were characterized as early malignant syphilis, and incapacitated the patient for work, but by September he was able to work again. At some time within the first two years, he had an attack of insensibility, which was followed by a hemiplegia, from which he entirely recovered in a comparatively short space of time. I saw him during the primary and early constitutional disease.

I next heard of him early in 1911, when I was asked to see him at his home. I found him huddled over the register, thin, cadaverous, constantly coughing and spitting. He was the typical picture of the advanced consumptive. His story was something as follows: He had been taken some weeks before with a cough which his first doctor had called bronchitis. This grew worse rather than better, and the diagnosis had been changed to pneumonia. As that persisted for some weeks, the sputum was examined for tubercle bacilli, with negative result. He was then sent to one of our larger hospitals, where he was tapped several times, but always without results. After that he returned to his brother's house, where I saw him. There is no record of the physical signs at that time, but there was absolute flatness on the left side which certainly had justified the tapping.

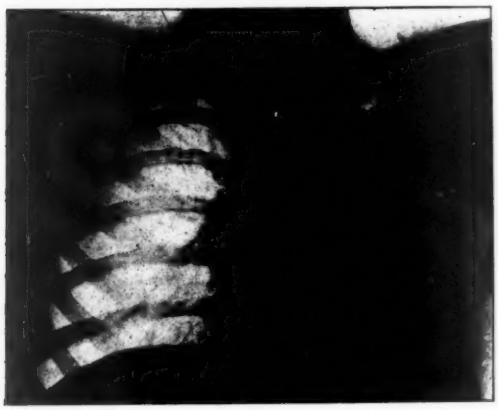
Bronchitis, pneumonia, tuberculosis, pleuritic effusion had all been considered and disproved. Examination of his sputum at that time disclosed neither tubercle bacilli nor spirochetae. A new growth of some kind was to be considered, and in view of his history, especially of the severe forms

that his syphilis had taken, syphilis seemed a fair assumption, or at least a good working diagnosis. He was put upon antisyphilitic treatment, chiefly iodides, and his improvement was immediate and wonderful.

He began to improve under antisyphilitic medication, and as soon as he was able to go out, the radiograph labelled C. N. 1 was taken, on May 9, 1911.



C. N. 1. May 9, 1911.



C. N. 2. May, 1914.

His general health improved and his ability to work increased. About a year after his chest symptoms began, he followed me to the Boston Dispensary. Dr. George Sears, Associate Professor of Medicine in Harvard University, was kind enough to see him there and dictated the following account of his condition.

Diagnosis by Dr. Sears. Less movement of left side than of right in respiration. Contraction of left side antero-posteriorly, which is most marked at level of fifth rib. Apex beat of heart felt in fifth space almost in the anterior axillary line. Cardiac impulse visible over whole area between apex beat and the sternum. Cardiac dullness is limited on right by left border of sternum. Left chest in front dull to flat throughout except in small area extending from clavicle downward to third interspace and laterally from sternum to three inches of the left, where percussion note is clearer. Voice sounds, except over limited area of good percussion, are somewhat bronchial in character, and the fremitus is increased down to third interspace; below that both are diminished and are lost at base. Expiration is prolonged and high-pitched down to third rib, below which the respiratory murmur diminishes rapidly, until it becomes inaudible. Except for coarse, crackling sounds, heard on respiration over whole left chest, no râles are audible. Percussion note over right front is somewhat diminished in resonance. Dulness increasing downward to flatness over whole left back. Respiration high pitched with prolonged expiration to angle of scapula; silence below. Bronchial voice to angle of scapula; much diminished below that. Fremitus lost from mid-scapula downward. On deep inspiration a leathery sound is heard over upper third of back. Right back seems less resonant than normal, the respiratory murmur is somewhat diminished and expiration is prolonged and slightly raised in pitch. A few crackles are heard in S. S. F. on full inspiration.

Notes on his case are fragmentary. He had 606 on March 19, 1912; on March 20, 1913, his luetin test was positive.

C. N. has gained steadily in general condition. He works regularly at his trade, that of house painter, but his lung has changed little. He passes among his friends as a healthy man, but he gets out of breath quite easily.

CASE 2, L. M., is one of hereditary syphilis brought to the Boston Dispensary in July, 1913, by the Commission for the Blind. She was at that time 20 years old and had spent a large portion of her life among various public institutions. Her father was an alcoholic and apparently died of locomotor ataxia, and the mother of Bright's disease. There are three children living, one 29, patient 20, and a girl of 14. There were two miscarriages, three children died in infancy, one brother at four of spinal trouble, one drowned and one of heart disease. The patient had paralysis of the left side at six years, diphtheria at thirteen, was sent to Rutland at 17, with diagnosis of tuberculosis.

She first appeared at the Boston Dispensary as an undersized, undeveloped girl, so blind that she needed a guide, walking with a very distinct limp, and giving the impression by her answers to questions that she was a little deaf and also undeveloped mentally. It is difficult to put together in chronological order all her pathological experiences, but in addition to experience mentioned above, she has been four times at the Waltham Hospital,—for left hemiplegia, for an operation of some sort, and for pneumonia. She was ten months at the Rutland Sanatorium for tuberculosis, though no tubercle bacilli were ever found there or elsewhere. She was a patient of the Eye and Ear Infirmary, where tuberculin was administered. For a year the right eye has troubled her.

She has had trouble with one hip, which has been called tubercular, but it is not a destructive lesion. She has lines at the corners of the mouth. Left side of body smaller, no respiratory movement on the left side. Atrophied perineal group and foot-drop; left side of chest dull on front and back; heart displaced to left.

The illustration marked Patient No. 2, L. M., is her radiogram.

The resemblance of the radiographic pictures in these two cases is very striking. In both the

dark shadow is confined to one side; in both the heart is drawn toward the affected side.

Both patients are syphilitic. In neither have tubercle bacilli been found. It does not seem

Patient No. 2. L. M. Hereditary. May, 1914.

possible to avoid a diagnosis of syphilis of the lung.

I have recently seen a very similar radiogram in which there was no evidence of syphilis. There was a negative Wassermann and the autopsy proved the diagnosis of malignant disease.

These two cases were among the earliest to arouse interest in syphilis of the lung in this vicinity. Many cases more or less resembling them have been discovered since, some of which I have been permitted to see.

From all of these cases, the following conclusion seems justified:

Disease of the lung, in which consolidation is found in unusual positions, or limited entirely to one lung—in which tubercle bacilli have not been found—may be considered suspicious of syphilis. If the Wassermann is positive, the suspicion is much greater and may almost be regarded as a certainty.

Certainly, consolidation in unusual positions, with the absence of tubercle bacilli and the presence of a positive Wassermann, does not permit the diagnosis of tuberculosis. These cases show, also, the very important fact that syphilis of the lung occurs in hereditary cases, that is, among the young,—the very individuals who are most subject to tuberculosis.

Book Reviews.

Orthopedic Surgery. By EDWARD H. BRADFORD, M.D., and ROBERT W. LOVETT, M.D. Fifth Edition. One volume of 416 pages, octavo, illustrated by 369 cuts. New York: William Wood & Company. 1915.

The fifth edition of Bradford and Lovett's Orthopedic Surgery follows the same general plan as the previous editions, covering the many conditions which are of orthopedic concern in concise form. It is essentially a students' text-book, and as such perhaps the best work on the subject in the English language.

Typical cases and methods of treatment are illustrated generously, and almost entirely from photographs. This is especially helpful in demonstrating the method of application of apparatus.

The discussion of adult orthopedic surgery is less complete than the discussion of the orthopedic conditions of childhood. A very conservative attitude is taken toward certain of the newer methods of treatment, such as the operative procedures for the relief of spinal caries and the treatment of scoliosis, but the future may very possibly prove this conservatism to be wise. The book will undoubtedly continue to occupy the important place it deserves.

The Treatment of Acute Infectious Diseases. By FRANK SHERMAN MEARA, M.D. New York: The MacMillan Company. 1916.

Dr. Meara, who is Professor of Therapeutics in the Cornell University Medical School, presents an admirable book. In limiting himself to the discussion of the treatment of acute infectious diseases he is able to present all the facts. Such chronic infections as syphilis and tuberculosis are purposely omitted, presumably because they are sufficiently excluded by the title of "acute infections," and also because the therapy of these two conditions constitutes separate monographs in each instance. Dr. Meara has adopted the plan of headings with sub-headings under each disease, with a valuable summary at the end of each chapter. The book reflects the personal opinion of the writer and avoids the long discursive résumé of all the various therapeutic procedures that have been recommended by various writers. Dr. Meara takes up in minute detail every important aspect of treatment, including nursing care, diet and caloric values, specific and symptomatic treatment. He avoids useless repetition by discussing certain fundamentals of symptomatic treatment in two early chapters. In the consideration of drug therapy he mentions only the few important drugs which he has personally found valuable. It is particularly refreshing to find a work of therapeutics that does not recommend the use of nearly all the drugs in the pharmacopeia as helpful in the stimulation in serious infectious disease. The index is unusually complete and valuable. All in all, it can be heartily recommended as a sound, adequate presentation of modern therapeutics of acute infectious diseases.

The Practical Medicine Series. Under the general editorial charge of CHARLES L. MIX, A.L., M.D. Vol. ix, Skin and Venereal Diseases, edited by OLIVER S. ORMSBY, M.D., and JAMES HERBERT MITCHELL, M.D. Vol. x, Nervous and Mental Diseases, edited by HUGH T. PATRICK, M.D., and PETER BASSOE, M.D. Chicago: The Year Book Publishers. 1915.

These two volumes, appearing simultaneously in the Practical Medicine Series for 1915, continue the presentation of a summary of progress in their respective fields during the preceding year.

The volume on cutaneous medicine records a considerable amount of new material developed from the study of thermal injuries and venereal diseases among the warring European armies, and from investigation of the Wassermann reaction, epithelioma and blastomycosis in America. There is an appendix by Dr. Harold N. Moyer, on miscellaneous topics, among which are included feminism, social education, primitive medicine, early medical history of Dublin, various topics derived from the European war, and the anatomic and mechanistic conception of disease presented by Goldthwait in his article in this JOURNAL on June 17, 1915.

The volume on nervous and mental diseases presents a systematic review of recent progress in the neuroses, in diseases of the meninges, of the brain, of the spinal cord, of the ganglia and of the peripheral nerves. In the section on mental diseases especial attention is given to the relation between mental defect and delinquency, to insanity and the war, to dementia precox and to manic depressive insanity.

Both volumes are well illustrated with full page plates and a number of text cuts.

Physiology of the Amino Acids. By FRANK P. UNDERHILL, Professor of Pathological Chemistry, Yale University. New Haven, Conn.: Yale University Press. 1916.

Within the last fifteen years the whole subject of protein metabolism has advanced, from the stage of speculation, to an assured foundation of chemical and physiological knowledge. The immense importance of proteins in normal and pathological physiology makes desirable the widest dissemination of the recently accumulated information concerning them. Professor Underhill's book on the amino acids presents an attempt to bring this to pass. The book is, in general, well-designed and well-written. Such complex chemical formulae as are necessary, are written in a manner readily comprehensible even by those whose knowledge of organic chemistry is elementary. The significance of particular amino acids in metabolism and in growth is very clearly brought out. Typographically, the work is as well made as are most books of the sort. There is practically no work of similar scope which would be found more satisfactory to the general reader, who desires to come abreast of current conceptions concerning protein metabolism.

Peroral Endoscopy and Laryngeal Surgery. By CHEVALIER JACKSON, M.D., Professor of Laryngology, University of Pittsburg; Consulting Laryngologist, Bronchoscopist, Esophagoscopist and Gastroscopist, Western Pennsylvania Hospital; Laryngologist, Presbyterian Hospital. First edition—quarto volume of 705 pages, 490 illustrations and six colored plates. St. Louis: The Laryngoscope Co. 1915.

This book is essential for the study and practice of modern endoscopy of the respiratory tract and the esophagus. The author is the highest authority on the subject, and a master of technique and detail. Much in the development of the art is the result of his genius, which includes a judicious adoption and generous acknowledgment of the work of others. The book reveals a series of possibilities which few have appreciated and which can be reached only by a well maintained equipment and careful training. The author shows that endoscopy has become a specialty in itself, requiring not only complete and well maintained apparatus, but a highly specialized technique. His standard is high throughout. No one, he says, should attempt to remove a foreign body from a human being until he has a hundred times removed a foreign body from a dog. He limits anesthetics, both local and general, to their minimum, believing that their convenience is out-weighed by their danger. He rightly says that no one is justified in giving anesthetics to overcome lack of skill. It would, however, be a justifiable opinion that with other operators, the patient would be safer with more anesthesia. The same might be said of other questions, such as exploratory bronchoscopy. The book is comprehensive and thorough. It seems dogmatic at times, and necessarily contains statements that will be challenged by other operators. But the author has in the past been able to prove assertions that seemed at first impossible. His experience, while it has helped him to find or to make an instrument for a great variety of conditions, has not increased the number of tubes, in fact it has diminished since his original set, and he has been a little shy of the large calibre in esophagoscopes. The chapter on Suspension Laryngoscopy was written especially for the book by Killian, a graceful tribute as well as an interesting addition.

The book is not only an exposition of endoscopy, but also a text-book of the surgical diseases of the trachea and bronchi, the diseases of the esophagus, and of laryngeal surgery. The illustrations are numerous, original and to the point.

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MASSACHUSETTS MEDICAL SOCIETY MEETING.

THE one hundred and thirty-fifth annual sessions of the Massachusetts Medical Society and its sections were held in Boston on Tuesday and Wednesday of last week, June 6 and 7, in accordance with the program printed in the issue of the JOURNAL for June 1. There was a large and interested attendance of members at the clinics, at the section meetings, and at the annual meeting. On the evening of June 6, Dr. Theodore C. Janeway of Baltimore delivered the Shattuck Lecture, which will be published in full in the issue of the JOURNAL for June 29. The annual discourse, which was delivered by Dr. David L. Edsall of Boston at the annual meeting on June 7, on "Movements in Medicine," will be published in the issue of the JOURNAL for June 22. Reports of the Council meeting and of the annual meeting will appear in early issues of the JOURNAL.

At the annual meeting, on June 7, the following officers of the Society were elected for the ensuing year: President, Dr. Samuel B. Woodward of Worcester; vice-president, Dr. F. W. Taylor of Cambridge; secretary, Dr. Walter L. Burrage of Boston; treasurer, Dr. Edward M. Buckingham of Boston; orator, Dr. P. E. Truesdale of Fall River; and librarian, Dr. Edwin H. Brigham of Brookline.

The annual dinner at the Copley-Plaza Hotel on the evening of June 7 was attended by over six hundred members. After introductory remarks by the retiring president, Dr. Charles F. Withington, the principal speakers of the evening were Mr. Channing Cox, speaker of the Massachusetts House of Representatives; Mr. Justice Lawton, of the Massachusetts Superior Court; the Rev. Dr. George A. Gordon, minister of the Old South Church; and Professor William T. Sedgwick, of the Massachusetts Institute of Technology. Mr. Cox spoke with especial emphasis of the importance of the physician's duty in guiding and directing the formation of public opinion with reference to medical legislation and in assisting legislators, by opinion and example, to frame and enact wise medical statutes for the Commonwealth. Mr. Lawton developed the idea of this responsible duty of the medical profession in the education of public opinion, pointing out and analyzing some of the psychologic distinctions between the temperamentally conservative attitude of the legal profession as contrasted with the experimental, progressive attitude of medicine, always receptive to new truth and prepared to adopt demonstrated advantageous changes in method. From the minister's standpoint, Dr. Gordon complimented the medical profession upon its reverence for fact and its readiness for service. Professor Sedgwick congratulated the physicians and the people of Massachusetts upon the excellence of the public health department of this Commonwealth, in whose reorganization, and in whose work already accomplished the profession at large has borne a helpful and creditable part. Dr. Joseph W. Courtney read a fable on "The Scientific Young Physician," which excited much mirth and interest. At the close of the evening Dr. Withington introduced the president-elect, Dr. Samuel B. Woodward of Worcester, who gracefully complimented the re-

tiring president upon his administration, and proposed the latter's health. The close of these exercises completed one of the most successful meetings in the history of the Society.

BREAD AND VITAMINES.

The recent great impetus given to the study of the so-called food deficiency diseases, has served to explain many previously misunderstood facts, and has extended very widely our conception of the rôle of food-stuffs in nutrition. In connection with the work of the U. S. Public Health Service on pellagra, Voegtlin, Sullivan, and Myers (Pub. Health Rep., Apr. 14, 1916) have reported a study on the food value of bread especially in relation to its vitamine content. Their conclusions and findings are of interest not alone to the physician concerned with pellagra, but also to every person who finds bread in very fact the staff of life.

These authors carried on their researches in the South, chiefly in Spartanburg County, South Carolina, but their results have a much wider range. They find that there has been a marked reduction in the vitamine content of the food of the people in the section studied, during the last twenty years. This reduction is laid to three causes: First in importance is the decrease in quantity of vitamine-rich foods ordinarily used, such as milk, fresh eggs and meat. This is due chiefly to the increased cost. Second is the introduction of highly milled cereal products, both of wheat and corn, in place of the older process articles which contained more of the husk and of the kernel of the grain and were correspondingly richer in vitamines. This difference especially affects the poorer classes, where bread is and always has been the chief article of diet. The third factor is the increased use of baking soda in the preparation of bread since the introduction of the highly milled flours and corn products. Soda is used to help raise the bread and too often is not combined with any acid, as for instance from sour milk. The authors quoted indicate that the alkali seems to destroy the vitamine content of the grain and thus to render the bread even more deficient in vitamines. In many sections they found that soda was added to other articles of food, such as beans, to shorten the time necessary for softening by cooking. Here the result is the same on the vitamines. This is a point worthy of special notice, and in places where bread is the chief food the physician has a new educational obligation.

In connection with the relation of vitamine-poor bread to pellagra and beri-beri, it is to be noted that Seidell has recently (Pub. Health Rep., Feb. 18, 1916) reported a method for extracting vitamines in concentrated form from brewer's yeast, which is one of the richest available sources of vitamines. By a method analogous to the extraction of alkaloids with hydrous aluminum silicate in colloidal form, he has prepared a concentrated vitamine which gives a full dose for an adult man in the bulk of five grams daily. The method, too, as Seidell points out, is applicable to other crude vitamine sources, and he has used it in particular on potatoes. Here, then, we have new light on the question of the vitamine deficiency diseases from two standpoints, one concerned with causation and the other with cure.

Whatever the ultimate chemical nature of vitamines may prove to be, and even if they are found not to be unit substances, the conception of such a group of accessory food substances has filled a valuable physiological and pathological requirement. The clinician, be he in city or country, specialist or general practitioner, must keep himself posted on this subject and especially remember the importance of his educational efforts just as much in infantile malnutrition, scurvy and obscure conditions of adult malnutrition, as in beri-beri and pellagra.

THE EFFECT OF ETHYL ALCOHOL ON THE TOXICITY OF PHENOL.

The almost universal acceptance by the general public, and even by the medical profession, that the toxicity and the germicidal power of phenol are reduced by ethyl alcohol, and that the latter is an efficient antidote for the former, does not seem to be borne out by experiment. Experience has already shown that the addition of alcohol to dilute carbolic acid does not prevent its action to produce gangrene. The presence of alcohol acts merely as a diluent. But, on the other hand, in high concentration, it favors the absorption of the phenol and thus rather increases than decreases its toxicity. There is no real chemical action between the two. Indeed,

experimentally, it was found that the administration of alcohol immediately after carbolic acid poisoning, as is done therapeutically, only helped to hasten a fatal termination. Somehow, however, animals previously intoxicated with ethyl alcohol seemed to stand phenol poisoning better, though fatal results in mice supervened about as quickly as otherwise. In the same way the determination* of the germicidal action of phenol and ethyl alcohol, and phenol and glycerine, under the Hygienic Laboratory technic—"The Determination of the Phenol Coefficient of Some Commercial Disinfectants" (Bulletin No. 82)—showed that by rendering the phenol more solvent the germicidal action was enhanced.

So much legislation in relation to the toxicity and the germicidal action of phenol and alcohol has been enacted under this erroneous principle that, in the light of these experiments, especially carried out with this point in view, they ought to be quickly corrected; and the public and the profession ought to be warned of the danger of relying upon the antidotal action of alcohol.

IMPORTANT STUDIES IN METABOLISM.

THE attention of readers is called to the two leading articles in this issue of the JOURNAL, the first by Dr. Benedict on "Respiratory Exchange," the second by Dr. Means on "Basal Metabolism,"—both presenting different aspects of the fundamental problem of metabolism, which has come so notably under the attention of clinical and experimental scientists in medicine during the past decade.

These two papers illustrate particularly the fact that the subject of metabolism, which at first was regarded chiefly from its laboratory side, has also a definite place in clinical medicine. The importance of Dr. Benedict's work on respiratory exchange is well recognized, though not as familiar as it should be to general practitioners. Dr. Means has been working for two years in the field of basal metabolism, and his previous reports have appeared in more purely technical journals. Both his present paper and that of Dr. Benedict are intended to present the facts developed by these years of research in a form to make them available for the use and benefit of clinical practitioners. The facts of value in connection with the study of metabolism are such as to make their knowledge essential, not merely to laboratory scientists but to those concerned in the actual daily treatment of the sick.

* Martin, L. Wilbert: United States Public Health Report, April 28, 1916, pp. 1046-54.

MEDICAL NOTES.

SLIGHT INCREASE IN NEW YORK DEATH-RATE.—According to a bulletin issued by the Department of Health, the death-rate last week was a trifle higher than the rate during the corresponding week of last year, the increase being due principally to an increase in the mortality of heart disease, nephritis and cancer, although bronchitis and diarrhea also contributed to it. The mortality of practically all the other diseases was lower during the past week, and thus offset, to a considerable degree, the increased mortality of the first group. The largest decreases were in the mortality of the contagious diseases and of broncho-pneumonia. The total deaths reported during the week were 1473, as compared with 1430 reported during the corresponding week of last year. The increase in the population accounts for all but eight deaths, the rates being 13.75 for the last week, and 13.68 for the week ending June 5, 1915. In the Boroughs of Brooklyn and Queens, the rate was lower during the past week than during the corresponding week of last year, whereas the rates in the other boroughs were higher. Correcting the borough rates, however, by referring all deaths to the borough where the deceased lived, makes the rate lower in Queens and Richmond, and higher in the other three boroughs. The death rate for the first twenty-three weeks of 1916 is 15.13, as compared with 15.34 for the corresponding period of last year.

AUXILIARY CLINICS FOR THE EXAMINATION OF PEDDLERS ESTABLISHED.—The occupational clinic of the Bureau of Preventable Diseases, New York City, has recently established an auxiliary clinic at a store situated in Manhattan, and another in Brooklyn, where peddlers, applying for licenses, are submitted to a medical inspection very similar to that which obtains at the Federal Quarantine Station. In this way the work of the division has been made a part of the office routine of the Bureau of Licenses, doing away with a considerable amount of hardship for the thousands of peddlers of all descriptions who apply for licenses, and effecting a great economy both in time and energy. At the same time, special examinations of industrial groups and food handlers can be carried on at the occupational clinic without the confusion and interruptions that were inevitable when large numbers of peddlers invaded the clinic.

The physicians assigned to work in these new offices established by the Bureau of Licenses

select those individuals who present any indication of marked malnutrition, skin eruption, or other condition which may excite suspicion as to the presence of tuberculosis, syphilis, other infections or venereal disease, and refer them to the occupational clinic, where they are submitted to a thorough physical examination, and where proper laboratory tests can be made, if necessary.

THE PREVENTION OF MENTAL DEFICIENCY DUE TO ALCOHOL AND SYPHILIS.—In a paper read before the recent conference on charities and correction, held in New York on May 25th, Dr. B. Sachs, while deprecating the tendency to blame parental alcoholism and syphilis for the greatest portion of mental defectives, expressed the firm belief that such factors were operative in at least a third of the cases. This group, therefore, represents that portion of the total which sanitary measures are best calculated to reach. It is to be hoped that the noticeable awakening of the world to the evils of even moderate indulgence in alcohol will prove an effective means of reducing our present large proportion of mental defectives.

In regard to syphilis, Dr. Sachs urged that hospital and other institutional authorities provide the special accommodation and treatment so badly needed by sufferers from this disease.

APPROPRIATION FOR BOSTON QUARANTINE STATION.—Report from Washington on June 5 states that an amendment has been offered to the Sundry Civil Bill now pending before the National Congress, providing for an appropriation of $150,000 to pay the City of Boston for its quarantine station equipment which was turned over to the United States Government on July 1, 1915, as noted in issues of the JOURNAL prior to that time. It was understood at the time that the national government should pay for Gallop's Island and the equipment of the quarantine station upon it, but no appropriation for that purpose has hitherto been made.

APPLICATION OF THE HARRISON DRUG LAW.—Report from Washington, D. C., on June 5, states that the United States Supreme Court has recently rendered a decision interpreting a disputed section of the Harrison Drug Law. This interpretation is to the effect that the provisions of the law apply only to those who dispense, prescribe or sell narcotic drugs and not to those who use such drugs themselves. If this decision stands, it would indicate that drug habitués cannot be prosecuted under the law for having the drug in their possession.

SUCCESSOR TO DR. EHRLICH.—It is announced that Professor August von Wassermann, chief of the Royal Institute for Infectious Diseases, in Berlin, has been appointed to succeed the late Professor Paul Ehrlich as director of the Institute for Experimental Therapy at Frankfort.

UNION OF TWO MEDICAL COLLEGES.—At a meeting of the alumni of the Jefferson Medical College in Philadelphia on June 2, the announcement was made of the final union between the Pennsylvania and the Medico-Chirurgical College of Philadelphia. The Jefferson Medical College is to retain its identity, but will become essentially the undergraduate medical department of the University of Pennsylvania. The Medico-Chirurgical College will become a graduate school in medicine.

AMERICAN HOSPITAL AT PANAMA.—Report from Panama states that the new buildings of the American Hospital at Colon have been completed and transferred to the United States authorities. The hospital has an unbroken sea frontage facing the prevalent wind. "Four buildings of reinforced concrete with tile roofs arranged on the pavilion plan, with an administration building in the middle, comprise the new plant. The facilities include an emergency ward, a laboratory, x-ray room, dark room and all other conveniences of a well-equipped modern hospital. The buildings are thoroughly screened and have amply protected verandas the length of the buildings, also an inclosed sun porch at one end."

PREVALENCE OF MENINGITIS, POLIOMYELITIS, SMALLPOX AND TYPHOID FEVER.—The weekly report of the United States Public Health Service for May 26 states that during the month of April, 1916, there were thirteen cases of cerebrospinal meningitis in Massachusetts, eleven in Maryland, and six in Wisconsin. There were five cases of poliomyelitis in Louisiana. In Minnesota there were 140 cases of smallpox and 62 of typhoid fever. There were 139 cases of smallpox in Wisconsin and 145 in Louisiana. There were 78 cases of typhoid each in Maryland and Wisconsin. The weekly report of the United States Public Health Service for June 2 further states that during the month of April, 1916, there were 6543 cases of malaria in Mississippi, 19 of meningitis in Ohio, 766 of pellagra and 15 of poliomyelitis in Mississippi, 211 of smallpox in Ohio and 170 of typhoid fever each in Ohio and Mississippi.

PREVALENCE OF TYPHOID FEVER IN THE UNITED STATES.—The *Journal of the American Medical Association* has recently published its annual survey of typhoid fever mortality in the fifty-seven cities of the United States having a population of 100,000 or over. In 1910 these cities had an annual typhoid death rate of 19.59 per hundred thousand population. In 1913 the rate was 12.77 and in 1915 it was 8.65. The lowest rate in 1915 was 1.8 in Cambridge, Mass., and the highest 35.1 in Nashville, Tenn. In 1914 the Nashville rate was 47.3. During the past year the typhoid mortality in Atlanta has fallen from 38.9 to 11.1. Besides Cambridge, the

only cities showing a typhoid death rate of less than 5 per 100,000 are Newark, Seattle, Milwaukee and Omaha. During 1915 the typhoid death rate increased in 14 of the 57 cities, most notably in Pittsburg, Pa., Dayton, Ohio, Lowell and New Bedford, Mass. The typhoid death rate of New Haven, Conn. is 18.3.

EUROPEAN WAR NOTES.

MENINGITIS AMONG BRITISH TROOPS.—In last week's issue of the JOURNAL we noted the prevalence of meningitis among the British troops last winter. The local government board has recently issued a report of the meningitis epidemic among British and Canadian troops in Salisbury in 1914.

"In his preliminary memorandum, Dr. Arthur Newsholme, medical officer of this board, says that during the years 1913 and 1914 cerebrospinal fever prevailed in this country to a somewhat greater extent than had previously been experienced, and in the first half of the year 1915, this increase assumed large proportions. The number of cases notified were: In 1913, 305; in 1914, 315, and in 1915 the number of cases in the civil population had increased to 2565. This increase coincided with the military mobilization of a large part of the male population. Dr. R. Bruce Low, writing on the prevalence and distribution of the disease during recent years, says:

"'Although the disease was present in England and Wales during 1914 and before that time, there is suggestion of a fresh strain of infection having been brought from Canada at the end of 1914 to this country by the first Canadian contingent which came to Salisbury Plain to undergo their final military training. It appears that cases had occurred among the Canadians in their camp at Valcartier before embarcation, and that other attacks among them were reported during the voyage to this country and just after their arrival. About twenty-nine cases had been observed among the Canadian troops up to the middle of February, and twenty-five of them proved fatal. The predisposition to the infection may perhaps have been increased by the unavoidable overcrowding in camp which at first took place, as also by the occurrence of cold, wet and inclement weather, and by the unusual exertion and fatigue incidental to the military training of young recruits.'

"In a paper published by Dr. R. J. Reece, one of the Board's assistant medical officers, in the *Journal of the Royal Army Medical Corps*, it appears that no fewer than 2290 cases were notified in the civil population from January to July, 1915, and 1088 among the military, a total of 3378 cases in seven months. Among the different commands the largest number of cases occurred in the Southern District, where 300 attacks were reported, including cases among the Canadian contingent on Salisbury Plain. The Eastern Command came next with 244 cases, followed by Aldershot with 200 during the seven months. The smallest number of military cases, viz., thirty-two, occurred in the Western Command."

ARRIVAL OF HARVARD UNIT.—Report from London states that the third Harvard unit, which sailed from New York on May 20 aboard the *Andania*, reached Falmouth, England, on May 30, on its way to a British base hospital in France.

BRITISH MEDICAL ASSOCIATION.—It is announced that, on account of the war, the annual meeting of the British Medical Association, which was to have been held at Cambridge, England, will be indefinitely postponed. The statutory general meeting will be held in London on July 28. Dr. Sir T. Clifford Allbutt, Regius Professor of Physics at Cambridge University, has been nominated as president of the Association for the ensuing year.

WAR RELIEF FUNDS.—On June 10, the totals of the principal New England relief funds for the European War reached the following amounts:

Allied Fund	$116,517.67
Serbian Fund	100,034.22
French Wounded Fund	86,607.86
Army Huts Fund	56,067.60
French Orphanage Fund	53,125.83
Armenian Fund	46,789.19
Polish Fund	36,781.21
Surgical Dressings Fund	35,115.67
Belgian Tobacco Fund	26,487.65
Facial Hospital Fund	21,251.25
Italian Fund	18,672.56
Artificial Limb Fund	9,017.00

BOSTON AND NEW ENGLAND.

THE WEEK'S DEATH RATE IN BOSTON.—During the week ending June 10, 1916, there were 202 deaths reported, with a rate of 13.85 per 1,000 population, as compared with 236 and a rate of 16.44 for the corresponding week of last year. There were 40 deaths under 1 year, as compared with 33 last year, and 61 deaths over 60 years of age, against 65 last year.

During the week the number of cases of principal reportable diseases were: Diphtheria, 58; scarlatina, 30; measles, 299; whooping cough, 33; typhoid fever, 0; tuberculosis, 47.

Included in the above were the following cases of non-residents: Diphtheria, 5; scarlatina, 5; measles, 4; tuberculosis, 2.

Total deaths from these diseases were: Diphtheria, 1; scarlatina, 1; measles, 5.

Included in the above were the following deaths of non-residents: Diphtheria, 1.

Carney Hospital House Officers' Association.—The house officers of the Carney Hospital have formed an association for the discussion of medical and surgical subjects. M. E. Barron, M.D., is the president, and J. J. McCaffrey, M.D., is the secretary. On May 24, 1916, Dr. H. O. Marcy, Ex-president of the American Medical Association, addressed the Association, together with the visiting staff, nurses and the sisters. Dr. Marcy delivered an interesting address on "Animal Ligatures."

Death from Anthrax at Woburn.—There has recently been reported the fourth of a series of deaths from anthrax among the residents of Winchester and Woburn, Mass. This latest case, a tannery employee at Winchester, died of the disease at the Massachusetts General Hospital.

Beri-Beri Aboard a Boston Schooner.—An epidemic of beri-beri occurred lately among the crew of the Boston schooner, *Florence Thurlow*, recently arrived at this port after an eighty-day voyage from Accra, on the African Gold Coast. The first mate of the crew became ill after about a fortnight at sea, and before the conclusion of the voyage, the second mate, the engineer, the boatswain and an able seaman were also ill. The captain diagnosticated their cases as beri-beri and his diagnosis was confirmed on arrival at Boston.

Boston University School of Medicine.—The annual meeting of the Alumni Association of the Boston University School of Medicine was held in this city on June 6. The principal address was by the retiring president, Dr. H. G. Batchelder. The following officers were elected for the ensuing year: President, Dr. John H. Bernett; first vice-president, Dr. Reuben T. Eaton; second vice-president, Dr. Wesley T. Lee; secretary, Dr. Harold L. Babcock; treasurer, Dr. Howard Moore; auditor, Dr. Nathaniel R. Perkins; directors, Dr. Hollis G. Batchelder, Dr. Percy G. Browne, Dr. Edwin R. Lewis, Dr. Elizabeth Ross, Dr. Conrad Smith; for the advisory committee, Dr. Herbert D. Boyd.

Baltimore Medical Alumni Meeting.—The annual meeting of the New England Alumni Association of the Maryland School of Medicine, the Baltimore Medical College and the Baltimore College of Physicians and Surgeons was held in this city on June 6. The principal addresses were by Dr. H. H. Sumner and by Dr. A. Lawrence Miner, the retiring president. The following officers were elected for the ensuing year: President, Dr. William T. Councilman; vice-president, Dr. W. E. Lawrence; secretary, Dr. Charles S. Gilman; treasurer, Dr. A. K. Yoosuf; vice-presidents for states, Maine, Dr. L. E. Willard; New Hampshire, Dr. Samuel Miller; Vermont, Dr. L. A. Russlow; Massachusetts, Dr. Richard Morris; Rhode Island, Dr. W. C. Gordon; Connecticut, Dr. F. M. Dunn.

Report on Insanity in 1854.—The May number of the bulletin of the Massachusetts State Board of Insanity quotes from a report made to the Legislature in 1854 on "Insanity and Idiocy in Massachusetts" by the Commission on Lunacy, then consisting of Levi Lincoln, Edward Jarvis and Increase Sumner. This report is well worth careful study and consideration:

"After making a careful survey, they determained that 'there were, in the autumn of 1854, in the State of Massachusetts, 2,632 lunatics and 1,087 idiots, making a total of 3,719 of these persons who need the care and protection of their friends or of the public for their support, restoration and recovery.' Of the lunatics, 1,522 were paupers; 625 were foreigners. Of the idiots, only 44 were foreigners. Quoting further, the report says: 'As the disordered stomach cannot ordinarily bear the common food that others in health enjoy and digest, but needs some change of diet in order to be restored, so the demented mind is generally troubled by the common ideas and thoughts which are found agreeable when in health, and cannot regain its former tone unless a different set of ideas is presented to it.....It is the unanimous opinion of the American Association of Medical Superintendents of Insane Asylums that not more than 250 patients should be gathered into one institution, and that 200 is a better number. When this matter was discussed there was no dissent as to the maximum, yet those who had the charge of the large hospitals and knew the disadvantages of large numbers thought that a lower number should be adopted. Two hundred and fifty were proposed by Drs. Bell, Chandler, Choate, Walker, Ray, Brown and Gray, Kirkbride, Curwen and Worthington, also by the Commissioners in Lunacy in England. Dr. Butler of Hartford, proposed 200. Dr. Fornerden of Baltimore, proposed 150 to 200....Besides the increased cost of maintaining and diminished efficiency of a large establishment, there is the strong objection of distance and difficulty of access which must limit the usefulness of large hospitals in the country.....The returns of physicians and others show that in their opinion, of the 2,632 insane persons in Massachusetts, 435 were curable and 2,018 incurable.'"

Newton Hospital Training School.—The annual commencement exercises of the Newton Hospital Training School were held at Newton, Mass., on June 1. Diplomas were awarded to a class of twenty-seven pupil candidates.

Boston Floating Hospital.—It is announced that the first cruise of the Boston Floating Hospital this season will be made on June 28. It is intended that the hospital ship shall make two

daily trips as it did last year. The medical staff will be under the direction of Dr. Henry I. Bowditch. The nursing staff will consist of seventy graduate nurses, to whom a course in pediatrics will be given during the summer.

RULES FOR PUBLIC DRINKING CUPS.—The Massachusetts State Department of Health has recently formulated and issued the following new series of rules regulating the use of public drinking cups and common roller towels in this Commonwealth. These rules will go in force on July 1:

"On and after July 1, 1916, it shall be unlawful to provide a common drinking cup—

"(a) In any public park, street or way.

"(b) In any building or premises used as a public institution, hotel, theatre, public hall or public school, or in any part of any factory, market, office building or store of any kind which is open to the general public.

"(c) In any railroad station, railroad car, steam or ferry boat.

"The term 'common drinking cup' as used in these regulations shall be construed to mean any vessel or utensil used for conveying water to the mouth, and available for common use by the public.

"On and after July 1, 1916, it shall be unlawful to provide a common towel—

"(a) In a lavatory used in connection with any public institution, schoolhouse, hotel, restaurant, theatre or public hall, or in any part of any factory, market, office building or store of any kind which is open to the general public.

"(b) In a lavatory used in connection with any railroad station, railroad car, steam or ferry boat.

"The term 'common towel' as used in these regulations shall be considered to mean a roller towel or a towel available for use by more than one person without being washed after such use."

BOSTON CITY HOSPITAL UNIT.—It is announced that the Boston City Hospital has recently organized a base hospital unit, for service in the event of war, under command of Dr. John J. Dowling, superintendent of the hospital. The personnel of the unit is as follows: Drs. Edward H. Nichols, Joshua C. Hubbard, Walter C. Howe, Halsey B. Loder, Arthur R. Kimpton, Irving J. Walker, Robert C. Cochrane, surgical officers; Dr. Allen Greenwood, ophthalmologist; Dr. Calvin B. Faunce, otologist and laryngologist; Dr. Arial W. George, x-ray; Drs. John J. Thomas, William H. Robey, Jr., senior medical officers; Drs. Francis W. Palfrey, Cadis, Phipps, Albert A. Hornor, W. Richard Ohler, medical officers; Dr. Edgar M. Medlar, bacteriologist; Dr. Leroy U. Gardner, pathologist; Dr. Edmund W. Wilson, adjutant; Dr. William F. Dolan, quartermaster. Miss Emma M. Nichols is in charge of the nursing staff.

BOARD OF HEALTH OF FITCHBURG.—The Fitchburg Board of Health, in submitting its twenty-sixth annual report, states that the total number of deaths for the year has been 556, of which 121 represent deaths of infants under one year of age. This increase in the number of infant deaths is caused by the prevalence of scarlet fever, diphtheria and whooping cough. The death rate per 1,000 population was 14.02.

DORCHESTER MEDICAL SOCIETY.—At the recent annual meeting of the Dorchester Medical Society, the following officers were elected for the ensuing year:—President, Dr. Francis X. Corr; vice-president, Dr. John F. Fennessey; secretary-treasurer, Dr. Carlton Allard. The following will serve on the board of directors: Dr. Samuel Crowell, Dr. J. Derbin and Dr. John P. Treanor.

OPEN AIR SCHOOLS EXHIBIT.—Attention is directed to the Open Air Schools Exhibit, prepared by the Boston Association for the Relief and Control of Tuberculosis, and now on view in the Art Gallery of the Boston Public Library. The exhibit consists of ninety photographs of open air schools, of which there are about 800 in the United States, the pictures being collected from different parts of the country. Not all of these photographs are of open air schools for tuberculous children, a large portion of them being for anemic and run-down children, and many for normal healthy children. The exhibit will close on June 24.

Obituary.

GEORGE HORTON TILDEN, M.D.

DR. GEORGE HORTON TILDEN, a former practitioner of Boston, died at Paris, France, May 30, 1916, aged 65 years. He was born at Lowell, Dec. 25, 1850, was a graduate of Harvard College in 1872 and of the Harvard Medical School in 1876. Serving as a house officer at the Massachusetts General Hospital, he practised as a specialist in dermatology and syphilis, and was clinical instructor in these subjects in Harvard from 1888 to 1891, being at the same time physician for diseases of the skin at the Boston City Hospital, and surgeon to the genito-urinary department of the Boston Dispensary. He was a Fellow of the Massachusetts Medical Society from 1875 to 1893, when he resigned and went to Japan. He had lived in Europe for many years.

Miscellany.

CINCINNATI AND TUBERCULOSIS.

THE city of Cincinnati realized that the tuberculosis death rate was 50% above the average and that it had failed to manifest a tendency to decline. Accordingly, the United States Public Health Service was requested to make a thorough study of the situation and submit a report. To show that something more than mere academic interest obtained, 19,932 workers in 154 factories of the city voluntarily submitted to a physical examination.

The conclusions reached point directly to the close connection between poverty and tuberculosis. The great factor underlying the entire problem was seemingly that of economic conditions. One-sixth of all tuberculosis cases came from cheap lodging houses. Alcoholism was a prominent cause, and often accelerated the course of the disease. Occupational hazards and bad working conditions were apparently responsible for about 20% of the cases, but in the majority of instances these hazards were not necessarily inherent in the occupation. Previous tuberculosis in the family occurred in practically a third of all the cases investigated. Dissipation, overcrowding, bad housing, and innate lack of personal responsibility, were also listed as causes.

An interesting feature of the report, and one which has not previously been dwelt upon in studies of this character, relates to the effect of immigration and the rate of growth of the population of a city upon the tuberculosis death rate. It is shown that cities with a population composed largely of racial stock having a limited resistance to tuberculosis are subject to a high mortality rate from that disease, while centers having a slow rate of population increase are likewise subject to a high tuberculosis rate. The evidence is submitted in a comparative table covering sixteen American cities. Almost without exception those with a high percentage of Irish, Scandinavian and German stock, and those in which the negro population is relatively large, have a correspondingly high mortality, while those where the Italian and Jewish element is proportionately great have a low tuberculosis death rate. Similarly, such cities as Detroit and Cleveland, with high rates of population increase, show a low tuberculosis mortality, while Cincinnati and Baltimore, with a relatively small population increase, have a high tuberculosis rate. Doubtless the true explanation of this discrepancy is that advanced by the authors, namely, that where the population increase is rapid, new buildings are erected to take the place of old insanitary structures, and better housing conditions prevail.

THYMOL FROM HORSEMINT.

THAT the commercial production in this country of thymol from horsemint may be, under favorable circumstances, a profitable undertaking, is indicated by the recent investigations of the United States Department of Agriculture, the results of which are published in Bulletin 372. Thymol is extensively used in medicine and forms the basis of a number of important pharmaceutical compounds. In the past it has been imported from Northern Europe, where it is manufactured from ajowan seed grown in Northern India. Now that the European War has reduced these importations from over 18,000 pounds in 1914 to a little more than 2,000 in 1915, it is believed that to some extent the demand can be supplied at home. For several years the Department of Agriculture has been conducting experiments with horsemint, which occurs as a common weed in many localities. These experiments have resulted in improving the plants by selection to a point which, it is said, warrants the use of horsemint for the commercial production of thymol.

Horsemint is found wild on light, sandy soils over the entire region from Southern New York to Florida and westward to Wisconsin, Kansas and Texas. It is probable that it will thrive under cultivation wherever it is found growing wild, but local economic conditions must be considered in determining whether or not its production would be profitable. The investigations of the Department of Agriculture indicate that by distilling the improved plants an average of 20 pounds of oil per acre may be obtained from first-year plantings, and that in succeeding years the yields should be at least 30 pounds per acre. The phenol content of this oil may be assumed to be about 70%, almost all of which is thymol. The yield of thymol per acre of horsemint, therefore, should be for the first year a little less than 13 pounds, and for succeeding years a little less than 20 pounds. As the average price of thymol for a number of years has been about $2 a pound, the gross returns per acre from a horsemint plantation are estimated in the bulletin already mentioned, at about $25.72 for the first year, and $38.58 for each succeeding year.

It is more difficult to estimate with accuracy the cost of producing the thymol. In the opinion of the investigators it is doubtful whether the profits from the industry will be sufficient to warrant anyone in engaging in it unless the horsemint is grown in connection with other oil-yielding plants for which a distilling apparatus is required. In that event, of course, the entire cost of the distilling plant cannot be charged against the thymol industry alone. For this reason, in the estimates of cost of production published in Bulletin 372, such items as land rent, taxes, depreciation, upkeep, and interest on the distilling plant have not been included. Excluding these items it is believed that thymol

can be produced at an approximate cost of $23 per acre the first year, and $19 per acre thereafter. This figure includes the growing of the plants, fertilizer, cultivation, harvesting, and distilling. A plantation of horsemint will not have to be replanted oftener than once in five years, and under average conditions may continue to give a good yield for a still longer time. After the first year a material reduction can be made in the cost of fertilizers if the distilled herb is returned to the soil. These facts account for the reduction in the cost of production after the first year.

Correspondence.

THE SINKING OF THE *SUSSEX*.

(From Our Special Correspondent Aboard.)

MILITARY HOSPITAL, ————, ENGLAND,
April 17, 1916.

Mr. Editor: Having passed through some of the experiences of a wounded Tommy since March 24, I am writing you today with a new point of view. I was on board the *Sussex* on that date, bound for a Red Cross hospital in France. When a torpedo struck us, I was fortunate enough to come off with only a fractured tibia, though many standing near did not fare so well. Some were killed outright and others died before help reached us. Fortunately the ship floated.

About midnight, after nine hours of waiting, a British destroyer came alongside to take off the wounded. I happened to be the first to go over the side. A flexible stretcher was sent on board. It was made of strips of bamboo laid lengthwise and covered with canvas. They rolled me in it like a big papoose, ropes were wound around me, two loops passed over a hook and I was pulled aloft to swing for a moment from the davits.

Below, I could just make out a group of figures on the dark deck of the destroyer, for every light had been extinguished. Then I was lowered to the destroyer and sailors gently untied the fastenings. There was trouble with the knots and one of the group shouted up to the officer on the deck of the *Sussex*, "Sir, let some 'un do the next lad as can tie a knot." The answer came back, "You never mind. I done that job myself." Still in the stretcher, they bore me along the dark deck past shadows I thought were guns, along a narrow passage and down a ladder into a brightly lighted room. Here a couple of men helped me into the chief engineer's bunk, and strapped me in lest the ship should roll. There was a young medical officer on board who attended the more serious cases. He was what is called in the Navy a surgeon's probationer and was, as I learned later, a third year medical student from Glasgow.

About five in the morning I was carried on deck. We were evidently in a harbor, but the only lights came from a hospital ship alongside. She had a row of green lights from bow to stern, which seemed to steam in the morning mist. Above shone a cross of red and white lights. I passed over the gang-plank on the shoulders of four stretcher bearers, through a double line of orderlies, down into the ship's kitchen and through the buffet window into a ward prepared for perhaps 30 patients. The beds were arranged with heads toward the stern. The frames were fastened to the floor and the springs suspended so as to swing like hammocks when the ship rolled. Medical officers moved from bed to bed examining the wounded as they were brought in. Nurses, or sisters as they are called in the army, hurried about, dressed in gray uniforms and red capes, with white caps which fluttered out behind them. An hour after our arrival every patient had been attended, one man had been borne off for amputation, the medical officers and extra nurses had disappeared, and two sisters remained in charge. Everything had been done with surprising quickness and precision. I looked about the room. It seemed somehow familiar, and a nurse, passing, explained that this was a sister ship to the *Sussex*, which had been changed into a hospital after the commencement of the war. The ward had not long before been the ship's dining-room. An orderly brought in some bovril and later bread and milk.

That afternoon we were loaded on to ambulance which came down to the pier. I lay beside George Crocker, a Harvard undergraduate, who had been on his way to a French Red Cross. He was quite unconscious from concussion of the brain, and his knee was dislocated as well. The ambulance jolted fearfully (it was a Ford) and an orderly had to hold Crocker to prevent his being shaken from the stretcher. I thought of the Ford ambulances that are said to have done such splendid work in the Vosges Mountains, and wondered how the passengers fared.

An order had come down from the War Office that we were to be taken into the Military Hospital, in spite of the fact that we were civilians and, for the most part, aliens. The local civilian hospital seems to have been full. We were lifted through the window of a low, brick hut, into a ward where rows of neat white beds awaited us. The former occupants had that morning been rushed off to a convalescent home so as to make room. Our clothes were taken, searched, and put away, and, after baths, we were soon in bed. A number of the patients were suffering from shock more than anything else, and these slept most of the time for several days. After that they left the hospital one by one until now only Crocker and I remain.

The beds have been filled with soldiers, some from "overseas," but most from the troops training about here. Many of the latter are Derby recruits who have been sent in for operations such as hernia or with sprained ankles, etc. These Derby men are a more heterogeneous assortment than their predecessors. Gentlemen of the better classes are being made into privates as well as officers, and in many cases privates of some experience are being trained as officers even though they drop their h's. On my left lies a man, a butcher by trade, who talks such thick cockney one can hardly understand him. On my right lies a banker who is evidently well educated. He has told me of marching and drilling which left his long-unused muscles stiff and sore, of nights spent on the barrack floors, and of rough meals with men entirely uncongenial. The time for consideration of the individual's feelings is past: England at last understands what the war has brought.

Tommy's day at the hospital begins at five in the morning, when he is washed and has his bed made by the night orderly and nurse. His first voluntary act is to borrow a match from a "mate" and light his cigarette. The day orderlies come on duty at 6 o'clock, and at 7.30 breakfast is brought from the cook-house, in great pails. If some of the patients are able to be up, they toast enough bread for the ward before the open-hearth fire. There is no means of heating except this. As far as possible, each man is held responsible for the care of his own plate, bowl, knife, fork and spoon. After breakfast comes a great scrubbing and sweeping, followed by tea in the middle of the morning. The medical officer makes rounds and the dressings are done. At noon comes a dinner which, although it may be neither daintily prepared nor even hot, is yet sufficient in amount. During the meal an orderly officer enters and demands, in a loud

voice, if there are any complaints. The ward orderly, speaking for everyone, replies, "No, sir."

In the afternoon, if it is "movie day," the convalescents don their blue woolen suits and red ties, and go off to the "pictures" in charge of a non-commissioned officer. Here they will be admitted free, shown to the best seats and served with tea and biscuits during the performance. On visiting afternoons, poor Tommy is talked to by good ladies who, no doubt, wish to cheer him up but often succeed in making him very uncomfortable. Afternoon tea is served in the ward and any soldier who has denied himself an egg at breakfast may have one then.

The orderly medical officer makes a hurried round before bed-time and, after a cup of soup, Tommy goes to sleep at 8 o'clock,— if he can.

The regular army nurses are required in many cases to serve on hospital ship, hospital train and at base hospital in rotation. They are assisted now by Voluntary Aid Detachment nurses, or V. A. D.'s, girls of little or no previous training who are under the supervision of St. John's Ambulance. As far as possible, these V. A. D.'s are replacing the orderlies who are being sent overseas to do the heavier hospital work there.

Sincerely yours,

W. G. P.

AN EXPERIENCE UNDER ETHER.

Milton, Mass., May 18, 1916.

Mr. Editor: On my rounds the other day one of my patients, now a young woman in the early twenties, handed me the enclosed manuscript which she had written as a composite of several experiences with ether anesthesia.

About twelve years ago the late Dr. Maurice H. Richardson operated upon her for chronic appendicitis, and I could not but regret that he did not know of this fantasy that followed his brilliant operation, as I know how responsive he was to such concomitants of his art.

It has been my experience that it is not unusual for patients to dread anesthesia after the first experience, excepting during childbirth, and yet the explanation for that is often somewhat indefinite. It is, therefore, with more than usual interest that I have read this flight in an "Ether Train," and with the thought that others might equally appreciate it, I hand it to you.

Yours very truly,

Walter A. Lane, M.D.

The Ether Train.

The train was rushing along through darkness and roaring noise. Inside, it was stuffy and dim. There was something the matter with every man on board, but like many a queer person each seemed to look on his peculiarity as an advantage.

One man had a tail, which was fastened not only at the conventional place, but also between his shoulders. It looked like the handle of a pitcher. With this individual I began conversation, for I always like to be neighborly.

"Rather close in this train," I remarked. "Had I been asked, I should have said it smelled badly of ether."

"*You* may object to that," he replied somewhat snappishly, "but I am above such things. I have trained the hairs of my tail through my lungs and nothing can hurt me."

"Ah," said I, impressively, "but if you have a bad appendix, your tail won't help you in the least."

A look of terror convulsed his features.

"Well, here's where I get off to have it out," he yelled.

And with singular abruptness and agility he dove backward through the window.

"Good riddance!" said a voice behind me, "He was bad for the baby."

I addressed myself next to two cigar merchants They had tongues fastened to their lower front teeth, like the frog I had once dissected, and they kept flipping them out to taste their cigar wrappings.

"It is a new plan," I remarked, "to use ether for fuel. I can't say I like it myself."

"The smell doesn't bother us in the least," they answered, with the same irritating superiority. "Nothing can hurt us because....."

"Your tongue won't help you in the least," I interrupted, "if you have a bad appendix."

With sudden fear they screamed, "Here's where we get off to have them out."

As their heels disappeared through the window, a voice behind me said "Good riddance!"

I thought the same myself, for the place was intolerably stuffy, and getting smaller every minute.

There was a man with huge white lobes to his ears. They were a foot long and had diamond earrings in them.

"Now for him," I thought.

"Doesn't this place strike you as ill ventilated?" I asked.

"If it did," he answered, with an ill-bred sneer, "I would cover my mouth with my ears."

"That won't help you in the least . . .," I began.

But with a fearful grimace, he interrupted, "Here's where I get off to have it out."

His method of exit was different from that of the others. He grew large. The train at the same time shrank, shutting me in. He disappeared on all sides; and the place became blackness that pressed against me like prickly rubber. This lasted a century. Then the train shut up inside me, and I was free.

I opened my eyes on the light of day and the kind face of a nurse. I tried to speak. I tried twice. Then my numbed lips obeyed and formed the words: "Where did I get off to have it out?"

CORRECTION AS TO NAPOLEON'S WOUNDS.

Boston, June 9, 1916.

Mr. Editor: In my letter June 1, p. 813, your proofreader was liberal (to imitate the British love for a pun and for a quaint phrase), to a degree; he should not have added "M.D." to my name.

Some of Napoleon's battle-wounds can now be specified (fuller references being given in my prior letter):

At Toulon: slight wound on head from spent ball (*Æsculape*, 1913, III, 228); from bayonet, above knee (O'Meara, II, 229; de Las Cases, I, part 2, 67).

At Arcola: sundry injuries and perhaps the greatest danger during his life (O'Meara, II, 227; II, 61; I, 199; *Æsculape*, 1913, III, 228, etc.).

At Alexandria: bullet-graze, nearly fatal (Blackwood's, 1912, CXCI, at 501).

At Damanhor, horse-kick, apparently more serious than stated in Boston Med. and Surg. Journ., April 20, 1916, at 581 (see *Æsculape*, 1913, III, 228).

At Marengo, slight, from cannon-ball (O'Meara, II, 227-9).

At Eckmühl, toe (O'Meara, I, 199).

At Ratisbon, heel (illustrated at *Æsculape*, 1913, III, 228; 1914, IV, 225; etc.).

At Arcis-sur-Aube, where he urged his horse over a smoking shell; after the explosion he emerged "covered with contusions and ecchymoses in great number" (see *Æsculape*, 1913, III, at 230). Similar bruises, etc., he received elsewhere while having eighteen other horses killed under him (as to this see O'Meara, II, 229), during the sixty odd battles in which he took part.

Alfred Ela.

BELGIAN PHYSICIANS' RELIEF FUND.

REPORT OF THE TREASURER OF THE COMMITTEE OF AMERICAN PHYSICIANS FOR THE AID OF THE BELGIAN PROFESSION, FOR THE MONTH OF MAY, 1916.

No contributions for the month of May, 1916.
Previously reported receipts $7,941.86
Previously reported disbursements:—

1,625 Standard Boxes of Food at $2.20	$3,575.00
1,274 Standard Boxes of Food at $2.30	2,930.20
353 Standard Boxes of Food at $2.28	804.84
Total Disbursements	$7,310.04
Balance	$631.82

F. F. SIMPSON, M.D., *Treasurer*,
7048 Jenkins Arcade Bldg.,
Pittsburgh, Pa.

SOCIETY NOTICE.

THE MASSACHUSETTS THERAPEUTIC MASSAGE ASSOCIATION.—The next meeting will be held at the Hotel Brunswick (Room G), at 7.45 p.m., Thursday, June 15.

A paper by Dr. Jay H. Radley of New York, on "Spinal Adjustment," will be read.

Dr. Charles A. Eastman of Amherst, who has done so much to elevate his own race—the Indian— and is now trying to improve the White, will address the Society on, "The Games, Exercises and Remedies of the Indians."

Members of the medical profession are invited.

Please be prompt and thus show your appreciation.

DOUGLAS GRAHAM, M.D., *President*,
Hotel Brunswick.
MRS. MABEL F. WALKER, *Secretary*,
115 Cedar Street, Malden, Mass.

APPOINTMENTS.

NEW YORK UNIVERSITY.—*Dr. Henry W. Wandless* has been appointed clinical professor of ophthalmology at the New York University and at the Bellevue Hospital Medical College.

UNIVERSITY OF CINCINNATI.—*Dr. Jesse F. Williams*, formerly assistant professor of hygiene at Columbia University, has been appointed professor of hygiene and physical education at the University of Cincinnati.

MARRIAGE.

ELMER S. BAGNALL, M.D., of Roslindale, Mass., to MISS AIDA H. SALMON of Boonton, N. J., June 3, 1916.

RECENT DEATHS.

DR. THOMAS FRANKLIN SMITH, who died recently at New York, was born in that city in 1833. He received the degree of M.D. in 1860 from the New York Medical College, and served as a surgeon in the Union Army throughout the Civil War. He was a charter member of the International Homeopathic Medical Association, and a member of the New York Homeopathic Medical Society. He was a member and for 23 years treasurer of the American Institute of Homeopathy. For many years he was manager of the New York Association for Improving the Condition of the Poor. He is survived by his widow, three daughters, and two sons.

DR. ALFRED HUGH MCCORMICK died at his home in Northampton, Mass., October 28, 1915, aged 44. He was a graduate of Trinity College, Ontario, in 1900, and settled in Northampton and joined the Massachusetts Medical Society in that year.

DR. AXEL FRIDOLF SWANSON of Cummington, died at Easthampton March 19, 1916, aged 35 years. He was a graduate of the Albany Medical College and joined the Massachusetts Medical Society in 1913.

DR. NATHAN JENKS, who died recently at Detroit, Mich., was a member of the American Association of Obstetricians and Gynecologists, and a Fellow of the American College of Surgeons. He is survived by his widow and by one daughter.

DR. ALBERT CURTIS PERVEIL, who died recently at Brooklyn, N. Y., was born in Hackensack, N. J., in 1874. After receiving the degree of M.D., from New York University Medical College, he became ship's surgeon for a time on a trans-Atlantic liner. Later he settled in Africa and practised his profession there for two years. After a brief return to the United States, he again went to Congo, where he became infected with trypanosomiasis, from which he finally died.

DR. ALFRED KING, who died of pneumonia on June 4, at Portland, Me., was born in 1861. He graduated from Colby College in 1883. For many years he had been a teacher in the Maine Medical School, where he was professor of surgery at the time of his death. He was a member of numerous national and local medical societies.

DR. JAMES TURNER SHERMAN, who died of pneumonia on June 6 at Dorchester, Mass., was born in Newport, R. I., in 1849. He graduated from the New York Homeopathic Medical College in 1869 and soon settled at Dorchester in the practice of his profession. He was a member of the Massachusetts Homeopathic Medical Society and the Massachusetts Surgical and Gynecological Society. He is survived by his widow and by two daughters.

DR. ABNER HOWARD POWERS, who died in Boston on May 13, was born in 1856. He received the degree of M.D. from Boston University in 1885. He was professor of surgery at Boston University and surgeon to the Massachusetts Homeopathic Hospital. He was a member of the American Institute of Homeopathy, the Massachusetts and Boston Homeopathic Medical Societies, and the Massachusetts Surgical and Gynecological Societies.

DR. NORMAN GREENE REOCH, who died recently in Winthrop, Mass., was born at Phoenix, R. I., in 1880. After studying at the Harvard Dental School, he began the study of his profession in Boston in 1893. He was for several years instructor in orthodontia in the Harvard Medical School and at the Forsyth Infirmary. He is survived by his widow.